IN THIS ISSUE—SUCCESSFUL ARMY TRUCKS

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The Automobile

Vol. XXXVI
No. 16

NEW YORK, APRIL 19, 1917

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Can You Look Ahead

to a certain future — to greater profits like Hudson Dealers can?

Does the car you sell offer you the right kind of a future? The opportunity to grow, to make money this year and the next? Can you, like Hudson dealers, see years of profits ahead?

In the early days of the automobile business many cars were started with a blueprint, a printed sales and advertising plan. Broad promises were made to secure dealers. Sometimes the cars were never built. It was necessary in those days for dealers to shift from car to car. What profits they did make in one season were generally used up in the next.

But mark the history of Hudson dealers. How few the changes. How permanent their business. All of these years have been money making years for Hudson dealers.

If you will look about, you will generally find that the leading automobile merchant in your community sells Hudsons. He shares the reputation for stability that Hudson enjoys. He knows that every contract he makes with Hudson is another step toward a greater future.

Once in a while circumstances compel us to make a change in our representation, or territory is divided and new dealers are added. Those dealers who would some day like to be a part of the Hudson organization are requested to send us their names. We want to know every real automobile merchant.

HUDSON SUPER SIX

HUDSON MOTOR CAR COMPANY
DETROIT, MICHIGAN

Hudson Super-Six, the largest selling fine car in the world

Editorial Contents, page 3

Advertisers' Index—Next to last page

Built Like an Elgin Watch by Elgin Watchmakers

Van Sicklen

ELGIN

SPEEDMETERS

Now Standard Equipment on 21 of America's Cars *of* Quality

The Van Sicklen Company
Elgin *Illinois*

The Automobile

Vol. XXXVI New York—Thursday, April 19, 1917—Chicago No. 16

U. S. Tax on Cars and Trucks

Ranging from $1 to $10, It Would Net $19,800,000 First Year

WASHINGTON, April 16—Automobiles and trucks may be taxed to defray part of the war expense.

Secretary of the Treasury W. G. McAdoo has formally recommended to Congress that motor vehicles be taxed as follows:

Selling Price	Tax
Under $500	$1.00
$500 to $750	2.00
$750 to $1,000	3.00
$1,000 to $1,500	5.00
$1,500 to $2,000	7.00
Over $2,000	10.00

It is estimated that the returns from such a tax would give the government $19,800,000 for the first year.

Other tax measures of interest to the entire industry include a proposal to reduce the income tax exemption from $3,000 for unmarried persons to $1,500 and from $4,000 for married persons to $3,000. The super-taxes on incomes above $3,000 would also be considerably increased.

It is also proposed to increase corporation taxes so as to bring in $100,000,000 and to increase the excess profits tax by making the present law applicable to the calendar year of 1916.

To raise $226,000,000 this year and $200,000,000 next year, it has been suggested that an increase in the excess profits tax could be made by making the present law applicable to the calendar year of 1916 or retroactive and applying the proposed new increases next year.

In providing that if the present excess profits tax of 8 per cent on corporation and partnership profits on more than $5,000 and 8 per cent of invested capital were made applicable to the calendar year 1916, the Secretary estimates, it would yield $226,000,000. He would give corporations and partnerships, however, until September next to pay the tax.

As to the excess profits tax for 1917, collectible in June, 1918, the existing law allows an exemption of $5,000 and 8 per cent on invested capital, and levies 8 per cent tax on the remainder of the profits of corporations and partnerships. If this tax, allowing the same exemptions, were increased to 10 per cent on profits in excess of 8 per cent and not more than 15 per cent of capital invested to 15 per cent on profits in excess of 15 per cent and not more than 25 per cent on capital invested; to 20 per cent on profits in excess of 25 per cent and not more than 50 per cent of capital invested, and to 25 per cent on profits in excess of 50 per cent of capital invested, the law, according to the Secretary, would yield $425,000,000.

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Orville Wright in New Aeroplane Companies

DAYTON, OHIO, April 14—Orville Wright is listed as an incorporator in two new aeroplane companies formed here this week. They are the Dayton Airplane Co. and the Wright Field Co. The incorporators are the same for the two companies, as follows: Orville Wright, E. A. Deeds, H. E. Talbott and H. E. Talbott, Jr.

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212,319 Men in Michigan Factories

DETROIT, April 17—There are 212,319 men employed in this state's automobile and parts factories, divided as follows:

Motor vehicles	91,707
Parts	47,349
Engine	5,709
Castings and drop forgings	30,526
Brass	9,101
Machinery and accessories	27,927

WEDNESDAY, APRIL 25

The Society of Automobile Engineers requests that you give all of this day to securing new members for the society. It wants 1000 new members this month. The government is looking to us to supply technical men where technical brains are needed. In this work of getting the right man into the right place the society wants members. It wants each member to get one new one this month. Do not let Wednesday, April 25, pass into history without getting one new application.

S. A. E. Meeting at Washington

War Conditions Demand Only 1-Day Session—Ottawa Beach Dropped

CHICAGO, April 16—War conditions resulted in the annual summer meeting of the Society of Automobile Engineers scheduled to be held the last week in June at Ottawa Beach, Lake Michigan, being called off to-day by the Council of the society in session here. An extensive canvass of many connected closely with the activities of the society showed a general feeling that few of the members could afford the time to spend 4 days on the east shore of Lake Michigan or at any other place. Each day finds the engineers more and more engrossed in war activities, and correspondingly fewer of the members with spare time for such a meeting.

Instead of 4 days at Ottawa Beach it was voted to-day to spend 1 day on the summer meeting and hold it in Washington, D. C., on Monday, June 25. Washington was decided because not a few government departments are very closely associated in the work of the society, and selecting Washington is hoped to not only economize time, but materially expedite matters.

With 1 day for a summer meeting instead of 3 or 4 as has been the custom since the start of the society, the broad program of former years will not be attempted. Two main reasons confronted the society in its deliberations on this subject to-day. One was the lack of time not only of chief engineers, but also of their assistants. Companies that formerly had ten or more of their engineers and assistants attend the summer meeting announced that such attendance would be impossible this year. Not only could the assistants and many factory and department heads not be spared for 4 or 5 days, but many of the chief engineers announced that they could not spare so much time.

Although the summer meeting in the

(*Continued on page* 764)

Plants Expand War Activities

Car Makers Build Trucks and Aero Engines—Some Make Shells, Etc.

DETROIT, April 16—Industrial preparedness and war needs are gradually affecting the automobile industry, though car and truck production continues at a normal rate. The great majority of manufacturers still await instructions from the government, and it is believed that many will not be asked to participate in the preparedness operations. Some are already engaged in the manufacture of munitions, army trucks and aeroplane motors, but have not been forced to reduce their production of cars or parts.

There are four large automobile makers either manufacturing or preparing to manufacture trucks and aeroplane engines, three truck manufacturers making army trucks and several parts concerns manufacturing shells, gunsights and other military necessities. Of these but one parts maker has reduced normal production to allow for munitions activities.

One carbureter maker has recently completed new furnaces which the government found suited for the manufacture of castings used in assembling war munitions, and arrangements have been made so that this concern will shortly engage in that work.

A western manufacturer of carbureters has arranged with the government for the aeroplane engine construction and will soon enter that field. This maker has already made a special aluminum aviation engine weighing 397 lb., and which has been found satisfactory.

A large automobile maker who refuses to divulge any information as to government work has replaced the usual State license tags on his service trucks with the tags used by the U. S. Army.

The employees of the Reo Motor Car Co. have organized and are holding meetings to sign up anyone who desires to enlist for military training and volunteer service. The officers are members of the Reo Rifle Club, which has been equipped by the government.

The Saxon Motor Car Co. is encouraging the enlistment of its employees in the army or navy by promising financial aid and participation in any bonuses earned in their absence as well as guaranteeing the men their present positions on the termination of the war. Men of seafaring experience who will enlist will be paid the difference between their present earnings at the Saxon factory and the wage paid by the government during their service or until the government makes satisfactory provision for caring for dependents of enlisted men.

Motor equipment valued at $100,000 and ranging from small side cars to touring cars, army trucks and armored machine gun cars will form the equipment of the Thirty-first Michigan Regiment when the plans of automobile makers are completed. The plan includes the motorizing of the machine gun company at a cost of $50,000 and the donation of trucks, touring cars and side cars valued at another $50,000 to the different battalions of the regiment. This will probably make the regiment one of the best motorized units in the National Guard. The Owen & Graham Co. donated a truck several days ago and a group of car makers, who at present prefer to remain in the background, will add $50,000 worth of the equipment.

Many inquiries are reaching the different factories regarding the future outlook for a large production of cars. The majority of the makers are optimistic and believe that the supply of labor and materials will continue sufficiently to insure a steady production, though it is believed that materials may advance considerably in price.

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Washington Office for S. A. E.

CHICAGO, April 17—A Washington office of the Society of Automobile Engineers will be opened in the Munsey Building in connection with the Council of National Defense as soon as arrangements can be made for such. This action decided upon by the council of the society in session here yesterday and to-day was brought about by the closer co-operation of the society with the various government departments, which work is increasing every day.

The society is well pleased with the results of its co-operation with the Quartermaster's Department as shown by the specifications of the 1½ and 3-ton military trucks given out this week. The truck standards division of the standards committee worked for several days with the quartermaster's staff in revising these specifications. Other work, and a great deal of it, remains to be done. It is possible the society will assist in aviation standardization work, and also in the training of mechanics for aviators as well as in training and supply mechanics for many other parts of the service.

The Council of National Defense has expressed a willingness for closer assistance by the S. A. E. and the Washington office in this light if it becomes a necessity. General manager Coker F. Clarkson or his assistant Herbert Chase would represent the society practically continuously in the Washington office. A clerical staff of one or two would be added.

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Chicago Speedway War College

CHICAGO, April 19—Within a month the Chicago Motor Speedway will start a war college for army drivers. Dario Resta has offered to serve as chief instructor. Drivers will be taught shooting at high speed.

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A. C. A. Pledges All for War

NEW YORK, April 19—The Automobile Club of America pledged all it has for use in the war at its annual meeting yesterday.

Patriotism Rules All Industry

Flag Raisings, Offers of Plants, Ambulances, Etc., to Government Continue

NEW YORK, April 18—Patriotism continues to rule the entire automobile industry. An elaborate flag-raising ceremony is scheduled for to-morrow at the Locomobile plant in Bridgeport, Conn., which is guarded by a machine gun and a searchlight day and night. The Metz factory, Waltham, Mass., held its flag raising last Wednesday.

The Fisk Tire & Rubber Co., Chicopee Falls, Mass., has offered its 45-acre athletic field to the government for a mobilization camp site; the Wagner Electric Co., St. Louis, Mo., has offered the government the use of the plant which has been making shells for the allies; the Climax Shock Absorber Co., Benton Harbor, Mich., will contribute 20 per cent to the Red Cross or similar funds on every set of shock absorbers sold to car owners before June 30; the Cole Motor Car Co. is putting an American flag paster on the windshield of every car.

Fifty-eight cars and trucks were pledged by the Automobile Trade Assn. of Philadelphia and the Motor Truck Assn. A $1,000 ambulance was also voted for war service. Cincinnati business men have offered an ambulance, four 2-ton trucks, seven motor kitchens, six light touring cars and two motorcycles to the First Regiment of the Ohio National Guard. The Automobile Club of St. Louis has offered the government the services of 5000 cars and 3000 club members. The Cleveland Automobile Club is conducting a Red Cross campaign, each club member being asked to secure ten Red Cross members.

The King armored car is to be sent all over the country by officers of the Marine Corps for the purpose of stimulating enlistments.

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Army to Inspect Indianapolis Speedway

INDIANAPOLIS, IND., April 16—Use of the Indianapolis Motor Speedway as a training station for army aviators is now practically assured. James A. Allison, secretary and treasurer, last week received a letter from the War Department asking when it would be convenient for army officers to inspect the grounds. Mr. Allison replied that the grounds could be inspected at any time.

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Pittsburgh Speedway Offered to U. S.

PITTSBURGH, April 13—The Pittsburgh Speedway has been offered to the government as a mobilization and military training camp.

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A. A. A. Furnishes U. S. War Maps

DETROIT, April 16—The American Automobile Assn. has furnished the government specially prepared war maps illustrating the complete highway system of the United States.

M. & A. M. Plans to Expand

Seven Members on Credit Committee—Mid-Season Meeting To Be Held Sept. 12

NEW YORK, April 16—The Motor and Accessory Manufacturers at the 3-day session starting last Thursday completed its various expansion plans. Seven members were elected to the credit committee; a 3-day mid-season meeting is scheduled at Atlantic City, Sept. 12, 13 and 14; the association will be represented on the motor transport committee of the Council of National Defense, E. H. Broadwell being the representative; a committee has been formed to work out the grouping of the members according to the products made; the association will co-operate with the Government in overcoming the mistakes of the Allies in getting parts to the trucks at the front; and seven new members were elected.

The session was the most enthusiastic one in the history of the association. Thursday was devoted to the recently formed Credit Committee. Seven members were elected to this committee, which is composed of credit and financial men, as follows: R. D. Mock, treasurer of the Hydraulic Pressed Steel Co., chairman; F. R. Wilhelmy, assistant treasurer of the Standard Parts Co.; R. M. McConnell, credit manager of the Firestone Tire & Rubber Co.; M. C. Dittmann, secretary and treasurer of the American Bronze Co.; G. H. Johnstone, credit manager of the Armour Curled Hair Co.; M. A. Moynihan, secretary and treasurer of the Gemmer Mfg. Co., and R. S. Preble, treasurer of the Splitdorf Electrical Co.

The credit committee has been formed to act in conjunction with the finance committee and to recommend changes in the credit gradings on automobile, truck, aeroplane, motorcycle and bicycle manufacturers. The committee will meet on the second Thursday of each month. The credit department is to be considerably enlarged and extended, making for a more elaborate credit service. L. M. Bradley, general manager of the M. & A. M., has been instructed to employ a credit manager who will be in charge of this work. The finance committee, with which the credit committee will cooperate, is composed of C. E. Thompson, president of the Steel Products Co., chairman; C. W. Stiger, president of the Stromberg Carburetor Co.; E. H. Broadwell, vice-president of the Fisk Rubber Co.; J. H. Fister, president of the Hydraulic Pressed Steel Co.; W. O. Rutherford, general sales manager of the B. F. Goodrich Co.; Christian Girl, president of the Standard Parts Co., and A. P. Sloan, Jr., president of the United Motors Corp.

During 1916 the credit department issued upon request to members 44,985 reports on 477 motor vehicle makers, a monthly average of 3749. Reports on other companies, such as accessory makers, jobbers and dealers, reached a total of 94,485, with a combined total of 139,470 reports during the year, which is growing constantly. While the employment of a credit manager and the elaboration of this system will mean $10,000 added expense, it is hoped this work can be carried on without raising the annual dues. The members will be shortly notified of this change.

Mid-Season Meeting

The question of holding a mid-season meeting was decided upon at the session. A 3-day meeting will be held at Atlantic City, Sept. 12, 13 and 14. The members will shortly receive a letter asking them as to how many of their executives, etc., will attend this meeting, which is the first one of this character in the history of the association. The annual meeting in January will be continued. The purpose of the mid-season meeting is to bring together the members and to discuss ways and means to enlarge the association. The mornings will be devoted to pleasure and the afternoons to business. A banquet is scheduled and the present crisis will be made an issue, speakers of national importance being made a feature of the meeting.

The motor transport committee, of which Alfred Reeves is chairman, has extended the motor and accessory manufacturers an invitation to become members. Mr. Reeves attended the meeting and explained the purposes and scope of that committee. E. H. Broadwell, vice-president of the Fisk Rubber Co., was appointed to represent the association on the committee.

The question of grouping the members according to the products they make followed a lengthy discussion and a committee composed of C. W. Stiger, W. O.

(*Continued on page* 764)

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N. A. C. C. and M. & A. M. Give S. A. E. Financial Aid

NEW YORK, April 17—The work of the Society of Automobile Engineers has been of such a large help to the automobile and accessory industry, that the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers have voted to participate in the financing of the association. This money will be used to defray the expenses incurred in the standards committee work, etc.

GET YOUR MAN

You must get one new man this month. The government needs him. The Society of Automobile Engineers needs him. You know the S. A. E. has a membership campaign for 1000 new members in April. Already the work is going ahead well. The Indiana section has secured fifty new applications. It will soon have more than one new man for each existing member. To get more concentration on the work the S. A. E. has set aside Wednesday, April 25, as Membership Day. You are asked to give that entire day to getting one or more new members. Mark the date on your desk calendar. Get it located in your brain center. It should become one of the most important days in the history of the S. A. E.

April 25 S. A. E. Members' Day

Each Member Asked to Concentrate on Getting New Members on That Date

CHICAGO, April 17—Additional stimulus was given the present campaign of the Society of Automobile Engineers by the Council of the society in session here declaring that April 25 will be known as Membership Day. On that day each member is asked to give up practically the entire day to getting new members.

So far the membership campaign has been a great success, and some of the sections have already doubled their membership. At to-night's meeting of the Mid-West section, held at the automobile club here, the section announced that it already had twenty new applications and a telegram was read by Councilor Muskovics of the Indiana section stating that that section with a membership of fifty-five has already fifty new applications. No word has come as yet from Detroit, where the headquarters of the membership are located, but it is expected that Chairman R. O. Gill of the membership committee of the S. A. E. will have one additional applicant for every present member in the Detroit zone. The Metropolitan section has added five new members.

Every member of the society, no matter whether he belongs to a section or not, should set out to get his one new member. If each member got a new one during this month, instead of adding 1000 new names to the membership roster there would be approximately 2500 new names added and the membership would rise in 1 month to the 5000 figure. Each member owes it to the society from now until the end of the month to get his new man. He owes it to give all of Wednesday, April 25, to this membership work. The latest figures from New York give a total new membership of 297, bringing the total S. A. E. membership to 2262.

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Dispatch Car on Transcontinental Trip

DETROIT, April 18—The National Midland Trail Assn. will conduct an automobile dispatch-carrying demonstration from Washington to the Pacific Coast to establish the feasibility of transmitting documents that cannot be telegraphed or mailed and to attract attention to the importance of the National Highway between Washington and California. The Louisville Automobile Club assumes responsibility for covering 400 miles of the demonstration picking up dispatches at Ashland and carrying them to Vincennes, Ind.

—

Gem May Build Aeroplanes

GRAND RAPIDS, MICH., April 13—The Gem Motor Car Corp. of this city has been offered a contract to build 1000 battle planes following specifications by French engineers. The contract has not yet been accepted.

Shortage in Cars Over $2000

Expected by Fall — Labor Diverted to Farms — Scarcity of Men in Detroit

DETROIT, April 17—Although at this time the government has made no demands upon the manufacturers of high priced cars, it is anticipated that there will be a serious shortage of that class of automobile by the early Fall. Labor is already being diverted to farming and munitions manufacturing purposes and the scarcity is being felt at Detroit. In addition, it is expected that the government will demand the highest quality of materials in all motor products manufactured for it, and as a consequence will produce a shortage of cars ranging in price from $2,000 upward. Car makers who have a large stock of parts and materials on hand are congratulating themselves, and several, it is rumored, who are not so fortunate, have already been obliged to reduce their output. Data on the situation are not yet available, since the government has not yet specified its complete requirements.

May Limit Exports

WASHINGTON, April 14—An "Exports Control Act" has been introduced in Congress at the suggestion of Secretary of Commerce Redfield and his assistants in the department of foreign and domestic commerce. Under it the President would have authority to prohibit the exportation of articles whenever necessary. At the Department of Commerce it was explained that this is principally an economic measure, designed not only to protect this country against the exportation during the present war of any article in such quantities as to limit the supply in this country to a point where the government or the people might suffer or to prevent the exportation of American products to such countries as might in turn sell them to Germany.

Rubber Producers to Co-operate With Government

WASHINGTON, D. C., April 13—Rubber producers and manufacturers will be called upon to co-operate fully with the Government in meeting war-time needs.

The advisory commission of the Council of National Defense has appointed a rubber committee to aid in organizing the rubber industry and to insure a quick and adequate supply of rubber for government work. This committee consists of H. Stuart Hotchkiss, United States Rubber Co., chairman; Arthur H. Marks, B. F. Goodrich Co., and Frederick C. Hood, Hood Rubber Co. The same men were unanimously appointed a committee to represent the Rubber Assn. of America, Inc., at a joint meeting of the executive committee and rubber advisory committee of the association held April 5. This committee was authorized to offer to the government through the advisory commission of the Council of National Defense the services of the Rubber Association and to co-operate with government committees appointed by the Defense Council, reporting from time to time to the executive committee of the Rubber Association how members of the association individually could best serve the interests of the government.

Price Changes

Maker and Model	Old Price	Present Price
Pierce-Arrow truck, 2-Ton	$3,000	$3,300
Pierce-Arrow truck, 5-Ton	4,500	5,000
White truck, 3-4-Ton	2,100	2,300
White truck, 1½-Ton	3,000	3,300
White truck, 3-Ton	3,700	4,100
White truck, 5-Ton	4,500	5,000
Mack, 1-Ton	2,150	2,250
Mack, 1½-Ton	2,500	2,700
Mack, 2-Ton	2,800	2,900
Mack, 3½-Ton	3,650	3,750
Mack, 5½-Ton	4,250	4,500
Mack, 7½-Ton	4,600	4,800
Anderson 68, 4 Pas. Brohm	1,775	1,875
Anderson 66, 5 Pas. Duplex-Drive	2,375	2,475
Anderson 66, 4 Pas. Sin. Drive	2,275	2,375

Dort Increases Price April 25

FLINT, MICH., April 16—The Dort Motor Car Co. will increase the price of its cars, effective April 25. The increase will amount to $30, making the new price of the Dort touring car and the Dort three-passenger roadster $725.

Another Briscoe Increase May 1

DETROIT, April 17—The Briscoe four-passenger touring car, roadster and two-passenger runabout will be advanced from $685 to $725 on May 1. The delivery car, open style, will be advanced from $700 to $735. The delivery car with the panel body will be advanced from $725 to $765.

Saxon Price Increase May 1

DETROIT, April 19—The Saxon Motor Car Co. will increase its car prices May 1. The amount will be announced later.

Premier to Advance May 1

NEW YORK, April 19—The Premier Motor Corp. will increase its car prices May 1. Announcement will be made later on the exact amount.

SECTIONS MUST FIGHT

Unless they get busy soon some of the seven sections of the S. A. E. will not have as many new members during April as they have members at present. The Indiana section has already announced that it has fifty new applications this month and that before the end of the week it will have more new applications than it has old members.

The Mid-West section in Chicago got twenty new applications in 1 day.

Detroit must get busy or it will be a second or third rater in this campaign.

No report has come from the pioneer Metropolitan section in New York. Perhaps it forgot to get started.

Philadelphia, Buffalo and Cleveland have yet to be heard from.

They should all remember that April 25 has been set aside as Membership Day—a day to be given over entirely to getting new members.

Detroit as Aviation Center

Aero Club Opens Campaign for Government School and 5000 Members

DETROIT, April 14—The Aero Club of Michigan launched a campaign last night to make Detroit the chief center of the aviation industry in America, and with the immediate object of promoting public interest in air transit and the manufacture of aeroplanes, of bringing a government school of aviation to Detroit, of securing an aviation field and of increasing the club's roster to 5000 or more.

About 800 engineers, manufacturers, mechanics and others accepted application blanks. G. Douglas Wardrop, editor of *Aerial Age*, discussed aeroplanes in Europe, and told of the important part they played in the war.

"It is authoritatively estimated that there are 100,000 or more aeroplanes in use by the warring nations," said Mr. Wardrop. "In England alone there are about fifty factories devoting from half to three-quarters of their time and energy making planes. There are nearly 3000 dirigibles in use.

"Every trained aviator that America sends to Europe is worth more than 200 soldiers. We do not hear so much now of the gas attacks as we did last year or of contact patrol attacks. Aeronauts become even more dangerous foes to the man in the trenches than gas. With powerful machine guns on board they hover over enemy trenches and mow down the men. It is through the work of aviators that the official recording of yardage gained and lost every day is learned.

"In the next great war, which some see even now, the aircraft will probably be the greatest factor, and not the submarine."

Motion pictures illustrated every phase of air fighting, and the famous Spad aeroplane was shown, as were photographs of the German Fokker, the French Avions de Chasse and the British triplanes.

U. S. May Establish Aero Department

WASHINGTON, April 14—A bill introduced in the Senate by Senator Morris Sheppard, of Texas, provides for the establishment of a Department of Aeronautics, to be headed by a Secretary of Aeronautics who would, naturally, be an additional member of the cabinet of the President.

Under the Department of Aeronautics, according to the bill of Senator Sheppard, would be placed the following bureaus: Bureau of land operations, naval operations, radio communications, construction, aeronautic research, motor power, personnel and accounts.

The appointment of an advisory board of seven members to be named by the President is provided.

Ford Waives Tractor Rights

Meets British Government Request—Cables Specifications 30,000 for U. S. by Aug. 1

DETROIT, April 18—*Special Telegram*—Henry Ford, at the request of the British Government, has waived patent rights on his tractor to permit government manufacture in large numbers. The request followed British Government observations of the action of Ford tractors now working 24 hr. a day in English and French fields. Ford cabled specifications of each of the 1000 parts in the tractor at his own expense to enable the British Government to proceed rapidly in their manufacture. Description of a single screw required several hundred words.

The success in England will hasten Ford tractor preparations in this country. Mr. Ford expects to have 30,000 tractors in use in America before Aug. 1. A large force of draughtsmen is now working at the Dearborn plant, preparing diagrams and specifications to be submitted to manufacturers in all parts of this country who will make parts from which the tractors can be assembled. Ford expects manufacturers to observe the President's request for unselfish service and co-operation. A large bearing maker has informed him he can have anything needed and price can be settled afterwards. Ford does not expect any remuneration from the British Government. He is making a study of Russian conditions and expects to have tractors in that country soon. His tractors are being used dragging plows and hauling and running saws and threshing separators and for other purposes. The tractor develops 25 hp. and runs on alcohol, gasoline or kerosene.

—

Herbert Will Manufacture Tractors

DETROIT, April 13—Clifford V. Herbert, son of Victor Herbert, the composer, will manufacture tractors, and expects to have his first tractor complete within the next 10 days, and believes he will be turning out about eighty a month by July. Mr. Herbert has been gaining practical experience by working in the Ford Motor Co. plant.

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Maker of Farmer Boy Tractor Refuses Order for 1500

COLUMBUS, OHIO, April 13—The McIntyre Mfg. Co. has refused an order from an exporting house for 1500 Farmer Boy tractors because of orders on its books. These were intended for shipments to Russia, Siberia and South America.

The McIntyre company has a standing order for the shipment of twenty-five tractors to London each week, but has not been able to keep up to that schedule. The new factory in West Goodale Street is nearing completion and the installation of new machinery will take place within a week. Then the output will be greatly increased. Several weeks ago there was an absolute embargo against the shipment of all kinds of machinery to Great Britain, but this has been lifted on farm tractors. The increasing shortage of farm labor in Great Britain has made the use of the tractors imperative.

The agitation for increased acreage throughout Ohio and adjoining States in order to swell the food supply has caused a rush for tractors, but because of previous orders for export, the McIntyre company has not been able to sell any tractors in this country.

—

Need 40,000 Army Trucks to New Specifications

WASHINGTON, April 14—The Quartermaster General of the Army has formally approved the specifications for army trucks recently agreed upon by representatives of his department and members of the Society of Automobile Engineers, thus paving the way for bids which will be asked about June 1 for probably 40,000 such trucks. These will include both 1½ and 3-ton trucks.

At present the army has 2600 trucks, nearly all on service on the Mexican border. Trucks will be purchased from the manufacturers and offers from private firms will not be accepted unless some unforeseen emergency arises. Army officials believe that domestic factories will be able to turn over to the government 1000 trucks within the first month after contracts are placed and that the rate will be increased to 4000 per month in 6 months. These figures are probably a minimum, as the combined production of Michigan manufacturers of trucks at present is between 200 and 300 daily, which, of course, also includes the 1-ton type.

The engineering corps in the new forces to be raised will be equipped with both tractor and caterpillar trucks, and special ambulance types will be purchased for the ambulance corps. Each motor truck company will be made up of twenty-seven cargo trucks, one repair and kitchen truck and two oil and gasoline supply trucks.

If recommendations made to the war department are adopted companies of 3-ton trucks will be used for hauling supplies and ammunition from the "rail heads" over good roads; companies of the 1½ ton trucks will be used over inferior roads. Volunteer companies of cars, motorcycles and trucks will be asked for.

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P. O. Truck Bids Open April 25

WASHINGTON, April 16—The postoffice department will open bids at 10 a. m. April 25 for furnishing ⅜-ton, ¾-ton, 1½-ton, and 3-ton gasoline motor trucks, and motor vehicle supplies as they may be ordered from time to time during the fiscal year beginning July 1, 1917, and ending June 30, 1918.

The specifications for all of these trucks call for delivery complete with body. In this respect, the postoffice department differs from the war department, as the latter buys the truck chassis for army purposes and builds its own body.

E. A. Buys Newtone Horn Business

Laboratories Organization Takes Over Patents, Orders on Hand—Plant Sold

BROOKLYN, N. Y., April 18—The E. A. Laboratories, Inc., accessory maker, has bought the business of the Automobile Supply Mfg. Co., maker of Newtone horns, together with its patents, trade marks, good will, unfilled contracts and orders on hand. Combined with the E. A. Laboratories' present facilities, those acquired in the purchase will provide ample capacity for the manufacture of the Handphones, Newtone and Ford magneto horns formerly made by the Automobile Supply concern, besides increasing production of the E. A. hand and motor-driven warning signals and other automobile accessories in the regular E. A. line.

The plant of the Newtone organization has been sold to Louis Leavitt, a Brooklyn paint manufacturer, who paid $137,500 plus incidental expenses. It is not known whether the plant will be continued as a going concern. A receiver was appointed the latter part of March, the company putting plant, materials and good-will on the block.

The Automobile Supply Mfg. Co. started manufacturing the Newtone horn in 1904. The company will be remembered for its participation in the suit in 1914 brought against it by the Lovell-McConnell Co., maker of the Klaxon, when it was charged with having infringed the Miller Reese Hutchison patents.

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Doble Develops Steam Truck for Army

DETROIT, April 14—The General Engineering Co. is completing a special design of the Doble steam power plant for use in trucks. The work is being hastened so that a finished truck may soon be submitted to the United States War Department for tests.

Among the inquiries received from the army and government sources it has been asked if the Doble truck can be used in connection with armored cars.

It is claimed that the use of kerosene effects a saving of about 25 per cent, and it is possible to use other fuel if kerosene is not available. If it is found necessary to burn wood or coal, grates which are carried in the truck body may replace the usual combustion chamber.

It is also claimed as an advantage that the Doble truck carries 50 per cent fewer spare parts than the usual truck.

The Doble truck power plant is of a very different design from that used in the passenger car. Its weight is entirely supported by the frame. Drive will be through a three-to-one reduction at the differential, and a fan will be employed behind the radiator or condenser to insure perfect condensation. As in the touring car there will be no clutch or gearshift mechanism in the truck.

Carbureters Key to Fuel Problem

Must Handle Wider Range—Chemists Seek Means To Boost Gasoline Output

KANSAS CITY, MO., April 17—"Meet us half way to avoid a tremendous shortage of gasoline for motor vehicles in 1919—or after the war—by devising carbureters to handle a wider range of fuels!"

This seems to be the gist of sentiment, and the appeal to the automobile industry, at the fifty-fourth meeting here of the American Chemical Society, April 10 to 14.

Gasoline, or, rather, motor fuel, was the paramount subject of discussion and conversation among the chemists at this spring meeting. The chemists told how they are trying to meet the needs of the automobile industry, as well as of the war situation and industrial development, with respect to petroleum and coal products. They pointed to the rapid increase in the production of gasoline by the cracking process, which Dr. Walter F. Rittman of Columbia University said would reach a billion gallons in 1918. Some means of getting more gasoline is absolutely necessary, since the production of petroleum has increased scarcely 30 per cent in 7 years while the consumption of gasoline had increased four times, and the number of automobiles eight times.

The chemists feel that it is up to them to get more gasoline from the available petroleum, but they urge that the automobile men meet them half way by devising carbureters that will handle a wider range of fuel.

Dr. Rittman also discussed the possibility of greater use of kerosene as motor fuel, but declared that kerosene has a narrower limit of explosion in air mixture than gasoline; the limit being so narrow that carbureters for it would have to be of great precision and refinement.

A paper by Arthur J. Boynton of Kansas University on the "Economic Resources of the Kansas City Zone" suggested the possibility of large manufacture of products from coal in this territory, in by-product ovens. This paper was especially interesting in connection with the comments of Dr. Gustave Egloff of Columbia University on the availability of benzol, or benzine, a coal tar product, for motor fuel. Benzol is badly needed as the starting point in the manufacture of dyestuffs; and enough could be produced now to supply one-twentieth of the demand for motor fuel. Dr. Egloff said that $25,000,000 worth of benzol and similar products could be obtained by scrubbing carbureted water gas furnished for heating and lighting in cities by light companies, the only result on the consumer being that he would have to use mantles instead of the unprotected flame for lighting.

The statement was frequently made that alcohol would not be a competitor of gasoline for motor fuel until gasoline reached 35 cents a gallon. There was no indication that any new processes of securing alcohol more cheaply were in sight.

E. P. Fisher, representing the H. L. Doherty interests, stimulated further the anxiety of the chemists over the supply of motor fuel, in an illustrated lecture on the welding and laying of gasoline pipe lines. Mr. Fisher said that motor trucks had proved four times as economical as mules in handling pipe.

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Rittman Process for Public Use

WASHINGTON, D. C., April 14—Senator James of Kentucky has offered a resolution authorizing the Secretary of the Interior to assign the so-called Rittman process for improvement in the manufacture of gasoline to the people of the United States and to make the process immediately available for public use.

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Russel Issues President's Address

DETROIT, April 13—The Russel Motor Axle Co., North Detroit, has had the address of President Wilson before Congress on April 2 published in pamphlet form in three colors and is mailing this book free.

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Packard Gets D. W. I. Order

DETROIT, April 14 — The Packard Motor Car Co. has received its first truck order from the Danish West Indies. The order includes a 1-ton and also a 1½-ton truck to be provided with army transport bodies and to be used by the marine corps.

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Erickson Front-Drive Truck Finished

DETROIT, April 14—C. A. Erickson, former chief engineer of the Scripps-Booth Corp., is en route to Detroit from Warren, Pa., in a truck which he designed, invented and manufactured, and which is driven through the front wheels. Mr. Erickson has been at work on the plans for more than 8 years.

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Ross Steering on Huron Tractor

LAFAYETTE, IND., April 13—The Ross Gear & Tool Co. has closed a contract for the use of its steering gear by the Huron Tractor Co., Detroit.

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60,000 Cars in Georgia

SAVANNAH, GA., April 13—Georgia now has close to 60,000 automobiles, if not more. Last year approximately 48,000 were registered.

5000 WANTED

Instead of 1000 new members during April the Society of Automobile Engineers really expects to get 2500. It wants each of the existing 2500 members to get one new man. That will double the membership. If you have not got your new man, get him. April 25 has been set aside for the work. It is Membership Day. Give that day to the S. A. E. Get on the telephone or get into your car and go to the factories in your locality; go into the engineering highways and byways and get your man.

Moreland Car Runs on Distillate

To Start $1,000,000 Plant at Burbank To Build Car at Moderate Price

LOS ANGELES, CAL., April 16—A passenger car to run on distillate and to sell at a moderate price will be manufactured by the Moreland Motor Co., which is at present building commercial vehicles. The present assembling plant in this city is to be retained.

Construction of the first factory unit of the company's projected $1,000,000 plant, at Burbank, a suburb of this city, is to begin at once. The site has been negotiated for and officials of the company declare the first building, which will cost $150,000, will be complete and ready for occupancy by Sept. 1.

Parts, including motors, transmission appliances, sheet metal coverings, drop forgings and everything except the standard units that are used in motor vehicles, farm tractors, marine and stationary engines will be made.

The architect's drawing shows provision for ten buildings. The main structure will be the engine plant, 300 by 150 ft. The smaller buildings will be of the saw-tooth design with an abundance of window space. The 25-acre plot will be divided along the most approved lines of industrial construction.

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Sheepshead Speedway Sale May 1

NEW YORK, April 13—The Sheepshead Bay Speedway on May 1 will be put on the block at a foreclosure sale in Brooklyn. Harry S. Harkness, president and chief backer of the Sheepshead Bay Speedway corporation, has taken over the mortgage on the speedway, having purchased the $2,040,000 first mortgage for $1,650,000, paying $550,000 in notes bearing his indorsement. Just what are Mr. Harkness's plans in regard to taking over the speedway at the foreclosure sale are not known, but there is a possibility of automobile racing being continued during the first half of the year, as the racing drivers, though signed up to enter the government service, have not as yet received any definite information as regards entering this service. Harkness has several of his cars at the track now which practically indicates that he will continue racing.

The Sheepshead speedway has been in financial difficulties, due to the very heavy overhead expenses. Last month the Supreme Court in Brooklyn handed down a decision ruling that the speedway corporation was indebted to the Coney Island Jockey Club to the amount of $2,135,161, and granting to the club a judgment of foreclosure on the corporation's grounds.

When Mr. Harkness took over the mortgage, he proposed that for the continuance of the enterprise the preferred stockholders put up $550,000 and adequate working capital, but as this would mean raising practically $750,000, the plan was dropped.

$60,000,000 for Ill. Roads

Bond Issue to Be Met by 100 Per Cent Increase in License Fees

CHICAGO, April 16—The State Legislature has passed the bill providing for the issue of $60,000,000 in bonds for building 4000 miles of a proposed 16,000-mile system of hard roads in Illinois. The proposition is to be put to a referendum vote at the next general election in the fall of 1918. No one has explained why the legislature thought it necessary to submit the proposition to the people when, almost at the same time this bill was passed, another was passed which provides that the motor vehicle license fees are to be increased 50 per cent beginning Jan. 1, 1918, and another 50 per cent Jan. 1, 1920, this revenue to be used in retiring this bond issue and interest. In fact, this increase in rates is expected to bring into the State funds some $65,000,000 over and above the amount necessary to retire the $60,000,000 bonds and interest, during the period for which the bonds are to run, or until 1944.

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Webb Bill Recommended

WASHINGTON, D. C., April 12—The Senate Interstate Commerce Committee voted to recommend the immediate passage of the Webb export bill, one of the measures strongly urged by President Wilson at the last session of Congress. The bill would permit American exporters to combine in the maintenance of selling agencies abroad.

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Rim Patent Suit Up June 4

NEW YORK, April 16—The infringement suit of the Perlman Rim Corp. against the Firestone Tire & Rubber Co. will come up for final trial on Monday, June 4. In view of the early date of the trial the court has denied the petition for a preliminary injunction. The suit was brought in February and charges infringement of the Perlman demountable rim patent No. 1,052,270, which achieved its chief prominence last year, when the United States Circuit Court of Appeals in this city declared the patent valid and infringed by the Standard Welding Co.

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NEW COMPANIES

DOVER, DEL., April 13—The H. J. Graham Engineering Corp. has been formed with a capital of $35,000 to manufacture automobile engines and kindred specialties. The incorporators are H. J. Graham, F. W. Unger and C. Y. Abbott.

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ALBANY, N. Y., April 13—The Utility Tractor Co., capitalized at $1,000,000, has been formed by J. F. Burke, J. F. Burke, Jr., and others of New York.

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APPLETON, WIS., April 14—The Auto Body Works, established several months ago to build all kinds of bodies for passenger and commercial motor vehicles, has incorporated its business under the style of Auto Body Works Co., with a capital stock of $5,000. The owners are Dudley Pierce, Gustave C. Seeger and Humphrey Pierce.

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BOSTON, April 12—The Speedometer Parts Co. has been incorporated with a capital of $25,000. The directors are: Rollin Abell, president; F. W. Wyman, Mattapan, treasurer, and G. M. Greene.

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PHILADELPHIA, April 16—The Renno-Leslie Motor Co. has been incorporated to manufacture automobiles and farm tractors. The capital is $750,000. The incorporators are J. W. Hills, Jr., C. H. Reed and W. L. Connor.

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The H. J. Graham Engineering Corp. has been incorporated for $35,000 to build motor trucks. The incorporators are: Frederick W. Unger, Herbert J. Graham and C. Yarnall Abbott. The truck designed by J. J. Graham will be a front drive and will be made in the chassis only.

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INDIANAPOLIS, April 16—The Gould Motor & Mfg. Co., Marion, Ind., has been formed, with a capital of $100,000, to manufacture a new type of gasoline engine. Among the incorporators are J. A. Hardman, O. M. Scarborough and Frank Barr.

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TORONTO, ONT., April 16—The Signal Motor Truck Co. of Canada, Ltd., has been incorporated, with a capital stock of $50,000, by John S. McLaughin, Frederick E. Earl, J. McFadden and others.

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CHICAGO, April 17—The Menometer Co. has been formed, with a capital of $100,000, to manufacture a patented metering device. E. H. McElroy, Ludwig Wilson and John Anderson are the incorporators.

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WASHINGTON, April 13—The Standard Motor Carriage Co. has been incorporated with a capital of $13,100,000.

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RACINE, WIS., April 14—Captain William Mitchell Lewis, former president and general manager of the Mitchell-Lewis Motor Co., and James W. Gilson, a former associate official in the concern, appear as incorporators of the Western Coil & Electrical Co., Racine, organized with a capital stock of $30,000.

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JACKSON, MICH., April 16—The Mott Wheel Works which, as was stated in an earlier issue, has moved to this city from New York, has been incorporated in the State of Michigan for $250,000.

ONE NEW MEMBER

You have to set aside Wednesday, April 25, as Membership Day for the S. A. E. On that day you are expected to get one or more new members for the society. Put the date on your desk calendar, enter it in your vest pocket notebook. Do your duty to the society on that date.

Hydraulic Steel to Expand

Negotiating for Steel Mill of 250,000-Ton Capacity—To Use Entire Capacity

CLEVELAND, April 13—The Hydraulic Pressed Steel Co. is negotiating to acquire a steel mill, the name of which has not yet been announced, of 250,000-tons capacity. Plans are that the mill will supply the Hydraulic company and the Cleveland Welding & Mfg. Co., which the Hydraulic concern owns, and that the mill will also manufacture a finished product itself. This deal, if completed, will make the Hydraulic company a unit from the source to the finished product. The Hydraulic company plans ultimately to use the mill's entire capacity.

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Nash to Double Truck Output

KENOSHA, WIS., April 17—The Nash Motors Co. will double its truck production. A conference of the factory heads was held recently, at which it was decided to produce a larger number of Jeffery trucks than the factory has ever built passenger cars in a single season.

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DETROIT, April 19—The General Motors Co. plans to erect a large Buick plant on the Pacific Coast to care for the Western business. It will probably be near the Chevrolet plant in Oakland.

The Springfield Body Corp. will open a service station at its new factory in Springwells, Mich. George L. Lavery will be in charge.

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TOLEDO, OHIO, April 17—The Willys-Overland Co. is installing one of the largest steel presses in its plant. The new press which makes side rails for automobiles has a pressure of 2000 tons and will press pieces of steel 17 ft. long and ⅜ in. thick. It is 31 ft. high and 20 ft. wide and is embedded in 15 ft. of solid concrete. Four men operate this machine daily and turn out 2000 side rails each 8 hr.

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WINDSOR, ONT., April 16—The Harroun Motors of Canada, Limited, has been granted a Dominion charter, with a capital of $100,000.

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DETROIT, April 16—The automobile industry is receiving considerable aid for shipments by the opening of navigation over the D. & C. route between Detroit and Cleveland. Many manufacturers are making large shipments of cars by this route. Dealers near Cleveland arrange to drive cars from that city to their destination.

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NEWARK, N. J., April 17—The Royal Mfg. Co. has been formed to build automobile specialties. The plant is at 43 Clinton Street.

Factory Developments

DETROIT, April 17—The Motors Metal Mfg. Co., formerly the Holihan Mfg. Co., has moved into its new plant. The main building of the plant is 400 ft. by 80 ft. and the company has purchased its own sidetracks. At a recent meeting directors were elected as follows: Gustavus D. Pope, H. A. Burnett, C. R. Talbot, S. E. Ferriss, L. N. Allen and William Christian. The officers elected were as follows: C. R. Talbot, president; H. A. Burnett, vice-president; William Christian, secretary-treasurer and general manager.

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BATTLE CREEK, MICH., April 17—The Wolverine Motor Corp. will build a plant and manufacture its cars here. Citizens are subscribing $50,000 for stock in this concern. A. H. Collins, who is the designer and promoter of the new plant, was formerly associated with the Locomobile company. The company states that it now has orders for 600 cars which will be the first year's output.

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NEWBURGH, N. Y., April 16—The Sunderman Corp., maker of the Sunderman Mouse Trap or vacuum carbureter, will open a brass foundry in 3 weeks, employing twenty to twenty-five men. The company's business this year, it is stated, will amount to approximately 200,000 carbureters. At present the output is limited to the amount of brass castings that can be purchased already made, which does not meet the demand. The new building will be 27 by 100 ft., three-story, and of brick structure. Only the first floor has been leased. The foundry will have a capacity of 1000 castings a day and later will reach 3000.

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TOLEDO, April 19—The Willys-Overland Co. has set aside 76 acres in ¼-acre plots on which employees can grow vegetables. Royal R. Scott, secretary of the company, is directing the movement.

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CUMBERLAND, MD., April 16—The Kelly-Springfield Tire Co. broke ground last week for its new plant here. This plant will give it a capacity at least four times that of the combined Akron, Wooster and Buffalo plants.

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NEW YORK, April 18—The Hudford Motor Car Co. is moving its plant to this city from Glendale, L. I. It has leased the four upper floors in the new concrete building at 2441 Third Avenue, also an annex adjoining on the north side of 134th Street, making a total area of about 60,000 sq. ft. It will employ about 300 operators.

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ST. JOSEPH, MICH., April 18—The Famous Trucks Mfg. Co., St. Joseph, Mich., purchased a plant and will build a factory.

BELOIT, WIS., April 14—The Waverly Novelty Co., Pittsburgh, Pa., which recently purchased the electric clock business of the Stewart-Warner Speedometer Corp., has made arrangements to establish a plant in Rockton, Ill., just south of Beloit, which is on the Wisconsin-Illinois state line. Until the new plant is ready, the manufacture of electric clocks will be continued in the Warner works of the corporation in Beloit. E. M. Thompson, inventor of the clock, is general superintendent.

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PHILADELPHIA, April 16—The Hale & Kilburn Co., maker of automobile bodies and railroad equipment, is erecting an eight-story factory building at Sixth and Filbert Streets, costing approximately $500,000.

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DECATUR, ILL., April 16—The architects have completed the plans for the buildings of the Comet Automobile Co. The principal structure will be 600 ft. by 150 ft. Brick, concrete and steel will be used in the construction and as nearly fireproof as possible. The estimated cost of the main building, office building and power house will be $150,000. The progressive system of assembling will be adopted, all parts entering the building at one end and the finished car emerging from the other.

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ALLENTOWN, PA., April 13—The International Motor Car Co. has awarded a contract for the erection of a one-story addition, 50 by 240 ft., to be used as an assembling plant. The construction of the two extensions, 50 by 54 ft., and 50 by 70 ft., has been completed, the first to be used for machine work.

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VASSAR, MICH., April 13—The Vassar Stamping Co., with $31,000 capital, fully paid, is building a large factory in this city. Officers are John E. Farber, president; Frank D. Lockwood, vice-president; Harry C. Shute, secretary, and R. A. Crobar, treasurer.

The company is an outgrowth of the old Portland Mfg. Co., Portland, Mich.

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CONNERSVILLE, IND., April 16—The Rex Mfg. Co., maker of sedan tops, will erect an addition to its plant. The building, which will be of brick and concrete, will be three stories high with full basement, 100 by 60 ft.

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ST. JOSEPH, MICH., April 16—The Famous Trucks Mfg. Co., a new concern, has taken over the plant of the Deitch-Denton Co. A stock offer of 250,000 shares of common at $10 a share is made. Authorized capital is $2,500,000.

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CLEVELAND, April 12—The Templar Motors Corp. has acquired a 14-acre site on West Madison Avenue, where it contemplates the erection of an automobile plant.

WICHITA, FALLS, TEX., April 17—The Wichita Falls Motor Co. has received an order from the Russian Government for 400 trucks, which will be manufactured at the company's plant here. The trucks are all to be delivered within the present year. It is reported that the company contemplates building a branch manufacturing plant at Dallas.

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PHILADELPHIA, April 16—The S. S. E. Automobile Co. will build a one-story, brick and concrete addition to its factory.

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PHILADELPHIA, April 17—The E. G. Budd Mfg. Co. will build a four-story, 124 by 175-ft. addition.

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EDGEWATER, N. J., April 15—The Duesenberg Motors Corp., which recently succeeded the Loew Victor Engine Co., Chicago, and the Duesenberg Motors Co., St. Paul, to build on a commercial scale the engines designed by F. S. Duesenberg, has started the manufacture of automobile and aeroplane engines at its local plant, recently taken over. The company is now prepared to accept and efficiently handle large orders.

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LANSING, MICH., April 13—Lansing factories have been exceptionally busy for the last 12 months. The Michigan Crank Shaft Co., The Auto Body Co. and the Lansing company have been compelled to operate night shifts. The Michigan Crank Shaft Co. has operated night shifts practically without a break since its reorganization 16 months ago.

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AKRON, OHIO, April 13—The Miller Rubber Co. has installed a new fire alarm system comprising the modern equipment of signaling apparatus with ten alarm boxes operated by breaking the glass and pulling the lever. These new call boxes and the factory whistle will automatically sound the number of the box four times in quick succession.

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CONNERSVILLE, IND., April 16—W. B. Ansted, president of the Central Mfg. Co., body manufacturer, whose plant was destroyed by fire 2 weeks ago, announced to-day that production has not been stopped. Contracts have been let for a new building. In the meantime the company is manufacturing bodies at the plant of the Rex Mfg. Co. and at the Connersville Industrial Building.

Mr. Ansted said a new plant will be erected as soon as possible. The new structure will be considerably larger than the plant which was destroyed with a loss of $150,000. The main building, for which a contract has been awarded, will be 800 by 125, and will be used for the manufacture of metal parts. Another building 100 by 50 ft. will also be erected. The company hopes to occupy its new plant by July 1.

News of Men in the Industry

PHILADELPHIA, April 16—Charles Fry, designer of the Biddle automobile in Philadelphia, has received permission from the Navy Department to enlist in the Naval Reserve as automobile instructor. Mr. Fry has only one arm and this is the first time a man with a physical disability of this character has been allowed to enlist.

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CLEVELAND, April 14—J. G. Utz has been appointed chief engineer of the Standard Parts Co. Mr. Utz, who is chairman of the general standards committee of the Society of Automobile Engineers, will have charge of research work in the chemical laboratories of the Standard Parts Co.

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DETROIT, April 14—J. G. Perrin, formerly chief engineer of the Timken-Detroit Axle Co., who has been seriously ill with typhoid fever, has returned from a 3-months' trip to North Carolina and other points in the South.

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DETROIT, April 14—W. F. Sturm has been appointed manager of the contest and trials section of the Chalmers Motor Co. advertising department. Mr. Sturm has handled transcontinental trips of the Stutz and Cadillac cars and had complete charge of the double transcontinental trip of the Hudson Super-six.

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MILWAUKEE, WIS., April 14—Frank R. Bacon, president of the Cutler-Hammer Mfg. Co., Milwaukee, maker of the C-H magnetic gearshift, has been appointed a captain in the quartermasters' reserve corps of the United States Army.

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NEW YORK, April 12—H. W. Scholl has become director of sales of the Walker M. Leavett Co., maker of Magnalite pistons and other parts. He was formerly sales engineer of the Splitdorf Electrical Co., Newark, N. J.

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DETROIT, April 18—C. O. Assmus has resigned as manager of the export field sales department of the Maxwell Motor Co.

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HARTFORD, WIS., April 16—H. S. Daniels has resigned as advertising manager of the Kissel Motor Car Co. to join the Dort Motor Car Co., Detroit. Mr. Daniels has been associated with the Kissel company for a number of years, having been responsible for the slogans, "All Year Car," "Hundred Point Six," "Double Six," etc.

Ralph Kay, now connected with the advertising department of the Stewart-Warner Speedometer Corp., Chicago, succeeds Mr. Daniels.

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DETROIT, April 19—G. U. Radoyz has resigned as assistant sales manager and advertising manager of the Hudson Motor Co. He will announce his plans later.

DETROIT, April 17—H. A. Goddard, connected with the Perfection Spring Co., Cleveland, and located in New York, will soon be transferred to this city.

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SALT LAKE CITY, UTAH, April 13—J. D. Vail, former manager of the Salt Lake City office of the H. W. Johns-Manville Co., has been appointed manager of the building materials department of that company's branch at Chicago.

In the future the Salt Lake City office will be under the management of C. F. Cate. The Great Falls, Mont., office will be managed independently of Salt Lake City by J. H. Roe.

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SOUTH BEND, IND., April 16—E. B. French, who has been assistant manager of the Harrisburg, Pa., branch of the S. F. Bowser Oil Tank & Pump Company, of Fort Wayne, has been made assistant to Eastern manager R. S. Colwell, at the Fort Wayne office.

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DETROIT, April 13—Walter F. Schmitt has been appointed district manager for the Packard Motor Car Co. of the territory west of the Mississippi River, including Memphis and Cincinnati. Mr. Schmitt was formerly field representative for the Packard company.

O. E. Brown has been appointed director-manager of the territory east of the Mississippi River, with the exception of Cincinnati and Memphis.

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LAPORTE, IND., April 13—Vernon E. Bush, vice-president and assistant sales manager of the Advance-Rumely Co., has resigned his position and will leave May 1 for New York where he will become associated with the White Motor Co., taking a position in the foreign sales department.

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DETROIT, April 17—Frank H. Trego is now located with the Trego Motors Corp. as managing vice-president at New Haven, Conn. Mr. Trego was formerly research engineer of the Packard Motor Car Co.

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DETROIT, April 16—Dick Farrington has been made advertising manager of the Parker Rust Proof Co. of America. Mr. Farrington was formerly advertising manager of the Gibson Auto Co., Indianapolis.

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DETROIT, April 19—L. C. McHugh of the Detroit Steel Products Co. has joined the Canadian Royal Flying Corps.

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DETROIT, April 19—Louis Schneider has become sales engineer of the Harrison Radiator Corp., Lockport, N. Y. He was formerly sales engineer of the Hyatt Roller Bearing Co.

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DETROIT, April 19—G. A. Richard has been appointed manager of the Michigan territory for the Firestone Tire & Rubber Co. He was formerly Pittsburgh branch manager of the Firestone company.

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DETROIT, April 19—Guy Morgan has resigned as president of the Abbott Corp. He will announce his plans later. No successor has yet been named.

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DETROIT, April 19—E. T. Backus has resigned as first assistant sales manager of the Ford Motor Co. to open a Ford branch in Baltimore. He has been with the Ford company 6 years.

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YORK, PA., April 17—D. M. Manning has been appointed director of exports in charge of the Bell Motor Car Co. Export Department, New York.

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Colonel Pardee Dead

NEW YORK, April 16—Colonel K. C. Pardee, well known in this city, died at his home in Chicago on April 12 at the age of 75. He was prominent in retail automobile circles for many years. He retired from business a year ago, making his home with his daughter in Chicago.

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PRODUCTION

72,100 Fords in March

DETROIT, April 17—The Ford Motor Co. manufactured 72,100 automobiles in March. These cars were all delivered and sold.

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3268 Saxons Built in March

DETROIT, April 16—The Saxon Motor Car Corp. shipped 3268 cars in March as compared with 2604 in March, 1916. This is the second largest month in the company's history. In April, 1916, 3405 cars were shipped. The company shipped 28,148 cars in 1916.

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2032 Cadillacs in March

DETROIT, April 16—The Cadillac Motor Car Co. produced 2032 cars in March.

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850 Coles in March

INDIANAPOLIS, April 17—The Cole Motor Car Co. in March shipped over 850 cars, more than double the corresponding month in 1916.

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March Biggest Month for Delco

DAYTON, OHIO, April 16—The Dayton Engineering Laboratories Co. in March completed a record-breaking month, when 39,570 complete Delco systems were shipped out to its customers. The company built 38,002 complete systems during the month, breaking the former record made in January by 3199 systems.

Gasoline Rise Expected

Government Purchases and Domestic Consumption Assure Higher Prices

NEW YORK, April 14—Gasoline prices are expected to rise in the near future, irrespective of what effect the war may have on government purchases. Domestic consumption of gasoline is not yet under the influences that operate during the later spring and summer months, when the use of gasoline for touring will be at its greatest. However, it is expected that there will be a large increase in the consumption this year, while a further expansion of the gasoline output is problematical, practically assuring higher prices.

The entrance of the United States into the war is expected to have a very pronounced effect upon the petroleum situation, already made acute by the heavy drafts of consumption and the failure of field operators to develop any new sources of crude oil production.

It is expected that the government gasoline requirements will be heavy, especially in equipping the coast motorboat patrol. And then again, strenuous efforts will be made to relieve the gasoline shortage in England and other Entente countries.

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Mexico Taxes Oils 10 Per Cent

MEXICO CITY, April 7—A stamp tax of 10 per cent ad valorem on crude oil and fuel oil from the Mexican fields has been declared. The value is to be fixed on the basis of oil of a specific gravity of 91, with a decrease in value for oil of greater density and an increase for less density. The decree exempts from taxes all oils and derivatives for sale or use within the country.

—

Government Buying Steel

DETROIT, April 16—The government continues to place large contracts for steel for the construction of ships, munition plants and army and navy equipments. Fully 100,000 tons will be required by the Navy Department in addition to the 3,000,000 tons of structural steel contracted for last week.

Railroad demands on the steel mills are light. Orders for rails since April 1 amounted only to 60,000 tons, and car contracts have called for only 50,000 tons, while locomotive builders have taken orders for but 129 engines.

—

Ford Orders 5,000,000 Lamps

CINCINNATI, OHIO, April 13—The Corcoran-Victor Co. has received an order for 5,000,000 lamps from the Ford Motor Co., Detroit, to be delivered between July, 1917, and July, 1918.

—

Locomobile Retires First Mortgage Bonds

NEW YORK, April 16—The Bankers Trust Co. as trustee, is calling in the first mortgage 10 year sinking fund 6 per cent gold bonds of the Locomobile Co. of America, bearing coupons maturing subsequent to June 1, 1917, at prices not exceeding 105 per cent of the face value of the bonds. All proposals should be in by May 14.

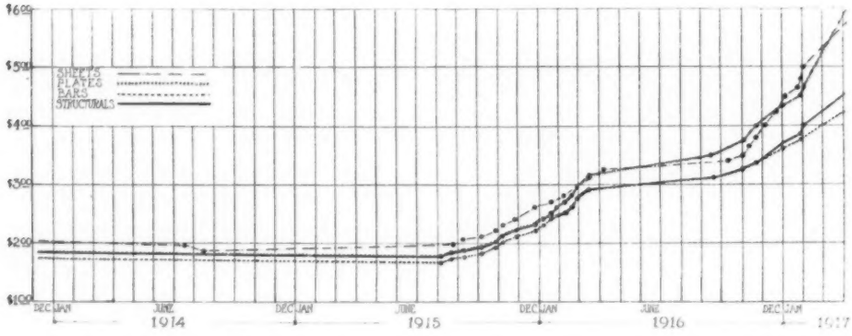

Chart showing sudden jump in prices of steel castings materials since 1915

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum, lb.	.60	.60	.60	.60	.60	.60	...
Antimony, lb.	.35	.35	.35	.35	.34	.34	— .01
Bessemer Steel, ton	75.00	75.00	75.00	75.00	75.00	75.00	...
Copper, Elec., lb.	.33	.33	.33	.33	.33	.33	...
Copper, Lake, lb.	.33⅛	.33⅛	.33⅛	.33⅛	.33⅛	.33¼	+ .00⅛
Cottonseed Oil, bbl.	15.00	15.00	15.20	15.00	15.20	15.45	+ .45
Fish Oil, Menhaden, Brown, gal.	.75	.75	.75	.75	.75	.75	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.65	1.65	1.75	1.75	1.75	1.75	+ .10
Lead, 100 lbs.	9.50	9.62½	9.62½	9.62½	9.62½	9.50	...
Linseed Oil, gal.	1.09	1.11	1.11	1.14	1.16	1.17	+ .08
Open-Hearth Steel, ton	75.00	75.00	75.00	75.00	75.00	75.00	...
Petroleum, bbl., Kans., crude	1.70	1.70	1.70	1.70	1.70	1.70	...
Petroleum, bbl., Pa., crude	3.05	3.05	3.05	3.05	3.05	3.05	...
Rapeseed Oil, refined, gal.	1.15	1.15	1.15	1.15	1.15	1.18	+ .03
Rubber, Fine Up-River, Para, lb.	.76½	.76½	.76½	.76½	.76½	.76½	...
Rubber, Ceylon, First Latex Crepe, lb.	.82	.82	.81½	.81	.81	.80½	— .01½
Sulphuric Acid, 60 Baume	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	54.75	54.75	54.75	55.00	55.00	55 25	+ .50
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Materials Prices Up 100%

Quotations on Elements Used in Manufacture of Steel Castings Increase

CHICAGO, April 12—That the relative cost of the principal elements entering into the manufacture of steel castings increased over 100 per cent from Feb. 1, 1915, to Feb. 1, 1917, may be seen by a comparison of the list published below, furnished by the Swedish Crucible Steel Co., Detroit:

	1915	1917
Pig iron, per gross ton.....	$15.00	$55.00
Scrap iron, per gross ton..	10.50	20.00
Fuel oil, per 100 gal.....	3.25	12.00
Manganese, per gross ton..	80.00	175.00
Ferro silicon, per gross ton.	80.00	150.00
Fire brick, per 1000.....	28.00	45.00
Skilled labor, per day.....	3.50	4.75
Common labor, per day....	2.00	3.00

The greatest increase has been in the price of pig iron and oil, which have tripled in the 2 years, although the prices of the alloys manganese and ferro silicon have felt an approximate increase of 100 per cent.

The increase in steel bars, plates, structurals and blue annealed steel sheets from Dec. 10, 1913, to Feb. 2, 1917, as reported by Joseph T. Ryerson & Son, Chicago, is as follows:

	Bars	Plates	Sheets	Structurals
Dec. 10, 1913....	1.75	1.85	2.05	1.85
July 16, 1914....	...	...	1.95	...
Aug. 14, 1914....	...	...	1.85	...
Aug. 5, 1915....	1.65	1.75	...	1.75
Aug. 21, 1915....	1.70	1.80	...	1.80
Aug. 24, 1915....	...	...	1.95	...
Sept. 11, 1915....	1.75	1.85	2.05	1.85
Oct. 4, 1915....	1.80	1.90	2.10	1.90
Oct. 28, 1915....	1.90	2.00	2.20	2.00
Nov. 9, 1915....	2.00	2.10	2.30	2.10
Nov. 26, 1915....	...	...	2.40	...
Nov. 29, 1915....	2.10	2.20	...	2.20
Dec. 24, 1915....	2.20	2.30	2.60	2.30
Jan. 8, 1916....	2.30	2.40	...	2.40
Jan. 22, 1916....	2.40	2.50	2.70	...
Jan. 27, 1916....	...	2.60	...	...
Feb. 8, 1916....	...	...	2.80	...
Feb. 11, 1916....	2.50	2.70	...	2.50
Feb. 21, 1916....	2.60	2.80	...	2.60
Feb. 28, 1916....	2.75	2.95	2.95	2.75
Mar. 15, 1916....	2.90	3.15	3.10	2.90
Apr. 5, 1916....	...	...	3.25	...
Sept. 15, 1916....	...	3.50	...	...
Sept. 23, 1916....	3.10	...	...	3.10
Oct. 11, 1916....	...	...	3.40	...
Nov. 1, 1916....	3.25	3.75	3.50	3.25
Nov. 10, 1916....	...	...	3.65	...
Nov. 22, 1916....	...	...	3.80	...
Nov. 23, 1916....	3.35	4.00	...	3.35
Dec. 5, 1916....	...	...	4.00	...
Dec. 22, 1916....	...	...	4.25	...
Jan. 2, 1917....	3.60	4.35	...	3.70
Jan. 4, 1917....	...	...	4.50	...
Jan. 25, 1917....	...	...	4.65	...
Jan. 31, 1917....	3.75	4.50	4.80	3.85
Feb. 2, 1917....	3.75	4.65	5.00	4.00
Prices to date...	4.25	6.00	5.75	4.50

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CAPITAL CHANGES

KENT, OHIO, April 16—The Mason Tire & Rubber Co. has voted to increase the capitalization from $1,000,000 to $3,000,000, the new capital to consist of $2,000,000 of 7 per cent preferred stock and $1,000,000 of common stock. The company at present is capitalized at $1,000,000. Its plant has a capacity of over 500 tires a day, and the increase in capital is made to allow for the tripling of the plant's capacity to 1500 tires per day within the next year and provide

additional working capital. The company's net earnings for March were sufficient to pay its preferred dividend requirements four times over.

At the present time over 200 distributers and dealers are handling Mason tires and tubes throughout the United States. The company has three direct factory branches, located in New York City, Cleveland and Kansas City.

—

TRENTON, N. J., April 16—Standard Roller Bearing Co. has decreased its capital from $8,000,000 to $160,000, by cutting the par value from $50 to $1 a share.

—

DETROIT, April 16—The Detroit Auto Dash Co. has increased its capital from $30,000 to $100,000.

Emerson Motor Truck Co. has increased its capital from $25,000 to $50,000.

—

IONIA, MICH., April 16—The Hayes-Ionia Co. has increased its capital from $152,500 to $757,500.

—

NEW YORK, April 16—Texas Co. has increased its capital from $44,000,000 to $55,000,000.

—

TRENTON, N. J., April 16—The Western Electric Co. has increased its capital from $15,750,000 to $30,750,000.

—

Columbia Issues $150,000 Stock

DETROIT, April 16—The Columbia Motors Co. will issue $150,000 worth of stock to be sold in the large centers of the country in the near future.

Bottom Prices for Issues

New Low Records Made—Weakness in All Quotations—No Support

NEW YORK, April 18—Automobile issues are not working satisfactorily these days. There is a wave of selling sweeping over these shares, with very little demand to offset the liquidation. As a result, motor and accessory issues are sliding downward to new low records. United Motors yesterday made a new low of 30¼, compared with an opening of 34⅛. The undertone in most of the motor issues was rather shaky. Maxwell prices yesterday went so low that the average return on the three classes of its stocks was about 17 per cent and 20 per cent each for the common and second preferred.

Quotations on Monday were a little higher than yesterday, the tire issues featuring the decline. Miller Rubber was 10 points lower than the previous Monday; Goodrich, 2 points; Firestone, 7 points; Goodyear, 24 points and Portage, 4 points. Goodrich common is off 30 points from its price of a year ago and on an 8 per cent basis.

Studebaker has dropped to 90. At yesterday's low the issue was down nearly 80 points from the high of last year. The price of the stock has now been marked down to a figure at which its asset value has been computed, it is stated, as $91 a share. Willys-Overland has reached 31¼, not very far from its February bottom.

War economics are taking on many unusual phases, and seem to have inspired most of the present liquidation in motor shares.

The Standard Parts Co. has listed its common and preferred on the Cleveland Exchange, the former quoting around 90 and the latter at 101½.

—

Hayes-Ionia Offers Stock

GRAND RAPIDS, MICH., April 16—The Hayes-Ionia Co. is offering $175,000 worth of 7 per cent cumulative sinking fund preferred stock to the public. The company, which was incorporated in 1911 in Michigan, manufactures automobile bodies and sheet metal parts. The principal customers are: The Willys-Overland Co., the Reo Motor Car Co. and the Olds Motor Works. The company has recently leased a new plant in Grand Rapids and has signed contracts utilizing its entire capacity, which makes an approximate increase of $2,250,000 in gross business.

The company claims its net assets are three times the total preferred stock issued, and that net earnings are four and one-half times the dividend requirements on preferred stock. Gross business of the company increased almost 400 per cent in the last 5 years.

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DIVIDENDS DECLARED

Kelsey Wheel Co., quarterly on preferred of $1.75, payable May 1, to stock of April 16.

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Pyrene Mfg. Co., quarterly of 2½ per cent, payable May 1 to stock of record April 27.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	68	72	—1
*J. I. Case T. M. Co. pfd.	83	86	—1
Chalmers Motor Co. com.	17	23	—3
Chalmers Motor Co. pfd.	..	..	..
*Chandler Motor Car Co.	98	99	+1
Chevrolet Motor Co.	110	114	—4
Fisher Body Corp. com.	33	39	..
Fisher Body Corp. pfd.	94	96	..
Fisk Rubber Co. com.	70	75	+2
Fisk Rubber Co. 1st pfd.	103	106	..
Fisk Rubber Co. 2d pfd.	70	100	..
Firestone Tire & Rubber Co. com.	132	137	—7
Firestone Tire & Rubber Co. pfd.	106	108	..
*General Motors Co. com.	108	108¾	—5
*General Motors Co. pfd.	85½	86½	—1½
*B. F. Goodrich Co. com.	50¼	50½	—2
*B. F. Goodrich Co. pfd.	107	109	—2½
Goodyear Tire & Rubber Co. com.	215	222	—24
Goodyear Tire & Rubber Co. pfd.	106	107	..
Grant Motor Car Corp.	6	8	..
Hupp Motor Car Corp. com.	3¾	4½	— ¼
Hupp Motor Car Corp. pfd.	78	82	..
International Motor Co. com.	..	16	..
International Motor Co. 1st pfd.	..	70	..
International Motor Co. 2d pfd.	..	30	..
*Kelly-Springfield Tire Co. com.	54½	55¾	— ½
*Kelly-Springfield Tire Co. 1st pfd.	88	94	+1
*Lee Rubber & Tire Corp.	20¾	21½	— ¼
*Maxwell Motor Co., Inc., com.	49¾	49⅞	—2¼
*Maxwell Motor Co., Inc., 1st pfd.	61	65	—6½
*Maxwell Motor Co., Inc., 2d pfd.	30	31	—4
Miller Rubber Co. com.	215	225	—10
Miller Rubber Co. pfd.	105	105½	+ ¼
Packard Motor Car Co. com.	..	165	..
Packard Motor Car Co. pfd.	..	101	..
Paige-Detroit Motor Car Co.	34	35	—3¼
Peerless Truck & Motor Corp.	14	18	..
Portage Rubber Co. com.	145	150	—4
Portage Rubber Co. pfd.	..	..	..
Regal Motor Car Co. pfd.	..	24	..
Reo Motor Car Co.	30½	31½	—4½
*Saxon Motor Car Corp.	52	53	..
Springfield Body Corp. com.	62	69	—6
Springfield Body Corp. pfd.	110	117	+5
Standard Motor Construction Co.	13½	14	+ ¾
*Stewart-Warner Speed. Corp.	76½	77½	..
*Studebaker Corp. com.	90	94	—4¾
*Studebaker Corp. pfd.	102	106	—1
Swinehart Tire & Rubber Co.	70	78	—4
United Motors Corp.	34⅛	34¼	—1⅛
*U. S. Rubber Co. com.	58	58¾	+2
*U. S. Rubber Co. pfd.	106¼	107¾	—2¼
*White Motor Co.	47	48	— ½
*Willys-Overland Co. com.	31¼	31½	—1
*Willys-Overland Co. pfd.	96½	97	..

*At close April 16, 1917. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	31	..
Chalmers Motor Co. com.	..	..	..
Chalmers Motor Co. pfd.	..	..	..
Continental Motor Corp. com.	7½	7¾	..
Continental Motor Corp. pfd.	..	99	..
Ford Motor Co. of Canada	..	300	..
General Motors Co. com.	..	..	..
General Motors Co. pfd.	..	..	..
Maxwell Motor Co. com.	..	..	..
Maxwell Motor Co. 1st pfd.	..	..	..
Maxwell Motor Co. 2d pfd.	..	..	..
Packard Motor Car Co. com.	..	160	..
Packard Motor Car Co. pfd.	..	100½	..
Paige-Detroit Motor Car Co.	..	34	..
Prudden Wheel Co.	..	28	..
Reo Motor Car Co.	30⅝	30¾	—3⅛
Studebaker Corp. com.	..	..	..
Studebaker Corp. pfd.	..	..	..
C. M. Hall Lamp Co.	25	28	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	..	..
Kelsey Wheel Co.	..	..	..
Regal Motor Car Co.	..	26½	..

Fisher Body Corp., quarterly of 1¾ per cent on preferred, payable May 1 to stock of record April 20.

Hood Rubber Co., quarterly of 1¾ per cent on preferred, payable May 1 to stock of record April 26.

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250-Mile Race for Cincinnati

CINCINNATI, April 17—The Decoration Day automobile speedway event here will be 250 miles, with a prize purse of $25,000, divided into ten awards, the winner to receive $10,000.

—

S. A. E. Meeting in Washington

(*Continued from page* 753)

sense it has been understood in the past has been called off, the activities of the society have not been reduced as such announcement might tend to convey. Instead of the large meeting there will be several smaller and more specific ones.

The tractor engineers who recently amalgamated with the S. A. E. are confronted with one of the largest problems of the day—the conservation of our agricultural resources and more intensified agriculture. It has been known for a long time that tractor farming means amazingly more than the mere substitution of motor power for animal power. The winter wheat crop situation is a national example of the economic advantage of tractor farming over animal farming. For best winter wheat crops in Kansas, for example, the plowing must be done in July. With horses this month is too hot, and often the ground is too hard. With tractors the heat is no factor. Statistics extending over many years prove the value by increased yield per acre of tractor farming.

This situation has brought the tractor into international importance, and the present demand for increased yield from our farms means perhaps a government demand for greatly increased tractor production. The lack of standardization in the tractor field as compared with the automobile and motor truck field makes such impossible for a time. The society faces this problem and its first work in the form of a special meeting will be to get the tractor makers and the government agricultural interests working closer. It is expected that in the near future a meeting to this end will be held, and it may be that several of such will be held during the coming summer.

The summer meeting of the Standards Committee in Cleveland on May 3 will take on greatly increased importance this year, and a large attendance from the society at large is expected. Besides the 140 men on the various divisions of the Standards Committee under the direction of Chairman John G. Utz, a call will be made to the society at large to attend, as the work of standardization is of greatest importance in these days of demand production.

It is possible that the new branch of marine engineering recently amalgamated with the society and representing motor boat work such as submarine chasers, etc., will call for a special meeting.

Maxwell Economy Day, May 23

$5,000 in Cash Prizes for Best Results with 1 Gal. Gasoline

DETROIT, April 16—The Maxwell Motor Car Co. has fixed May 23 as national economy day, when $5,000 in cash prizes are to be distributed among dealers, together with the award of the National Maxwell Economy Championship Cup.

Owners' cars only will be used. The dealers must agree to arrange for the use of two Maxwell five-passenger touring cars now in owner's service and which he is to borrow for the day. The two cars will make the run together, each carrying four passengers. The 1-gal. gasoline tanks will be provided each participant and will be attached to the windshield. Prizes will be: First prize, $200 in gold; second prize, $150; third, fourth and fifth prizes, $100 each; sixth and seventh prizes, $75 each; eighth, ninth and tenth prizes, $50 each.

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Chalmers 24-Hr. High Gear Run for Minimum Speed

DETROIT, April 17—The Chalmers Motor Co., which has just engaged William F. Sturm as manager of Contests and Trials, will hold the first of its tests starting to-morrow noon. This will be a 24-hr. run on high gear to demonstrate the ability of the car to run at minimum speed. The drivers will endeavor to make the lowest possible mileage at the end of 24 hr. The car will be taken from the stock of the Robinson company, local Chalmers distributer, and will have the first and second speeds removed. It is intended at present to have the regular touring setting on the carbureter so that the conditions will be as near touring practice as possible on the car. The test will be run through the outlying districts of the city of Detroit, and one of the objects will be to keep the motor running continuously.

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M. & A. M. Plans Expansion

(*Continued from page* 755)

Rutherford and L. M. Bradley was appointed to work out a plan for such a grouping, the same to be presented at the next meeting of the executive committee. A vote of the membership showed that 95 per cent of the members were in favor of the grouping plan. While the committee has not had the opportunity to meet it is possible that such groups as the following will be formed: Motor, tire and rubber, electrical, axle, bearings, wheel, body, gear, carburetor, spring, steel metals, etc.

Grouping of Members

With the above arrangement, because of the multiplicity of products manufactured by many of the members, a large proportion of the membership will be in several groups. It was also decided that within the next 60 to 90 days each member will be called upon to thoroughly familiarize himself with the work accomplished.

The advisability of holding periodical meetings of the credit managers of the entire committee was decided upon. It is probable that the committee may hold conventions at least every 6 months, if not oftener.

It was voted that the work being accomplished by the American Automobile Association and the Society of Automotive Engineers is of such an exceptional nature, affecting the entire industry, that the M. & A. M. will lend the two its financial support.

The board of directors of the Motor and Accessory Manufacturers has appointed a committee of which C. W. Stiger, president, is chairman. This committee will mobilize the resources, both materials and men, of the members for the purpose of co-operating with the Government in all its needs.

The association has in mind the mistakes of the Allies in its truck service at the front and has plans for eliminating any such errors, such as the incomplete supplying of parts, etc. The association plans to take over this work completely.

Seven new members were elected as follows: Standard Steel Castings Co., Cleveland, cast steel truck wheels, miscellaneous castings; the Standard Woven Fabric Co., Walpole, Mass., brake linings, clutch facings, friction tape, rubber goods; Jackson Cushion Spring Co., Jackson, Mich., cushion seat and back springs and spring constructions; Jacobson Machine Mfg. Co., Warren, Pa., axles, transmissions, differentials and parts; National Malleable Castings Co., Cleveland, malleable iron castings; Merchant & Evans Co., Philadelphia, clutches, universal alignments, joints, grease cups; Weston Electrical Instrument Co., Newark, N. J., electrical measuring instruments and accessories.

The Standard Roller Bearing Co., Philadelphia, making running gears and axles, and the Armour Curled Hair Works, Chicago, were reinstated in the membership of the association.

Two of the board members were absent from the meeting, E. W. Beach, president of the Manufacturers Foundry Co., Waterbury, Conn., being called out by his regiment, and W. C. Rands of Detroit, who telegraphed his inability to attend. Those present included: C. W. Stiger, C. E. Thompson, E. H. Broadwell, T. J. Wetzel, L. M. Wainwright, A. P. Sloan, Jr., J. H. Foster, W. O. Rutherford, W. M. Sweet, Christian Girl and general manager L. M. Bradley.

GO AFTER HIM

Do not overlook reading on other pages of this issue about the Society of Automobile Engineers getting 1000 new members during April. To do this each member must get one new application. To do this April 25 has been set aside as Membership Day. You owe that day to the S. A. E. Give it over to getting a new member. Do not sit in your office and expect to get the new member. Jump in your car and get out among the factories in your locality. Get some of the best dealers in your town. They should be associates.

The Automobile

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Gear Ratio Ranges

THE effect of gear ratio on the speed range at which the greatest torque is available is so important that it is well worth while to question whether or not everything has been done to secure the utmost efficiency in this respect. There are a great many concerns which are furnishing one gear ratio for flat country work and another reduction for dwellers in the hilly territories. This is undoubtedly to the advantage of the user of the car, and although naturally adding somewhat to the cost of manufacture, it can hardly be questioned as a justifiable expenditure.

What should be considered, however, is would it not be worth while to go even further in this respect and instead of merely fitting a different rear axle ratio for the hilly and level countries, an entirely different reduction layout be used to suit particular cases? There is no doubt that many purchasers of cars are buying more power, or rather increased torque at low speeds, simply because the gear reductions available are not correct for the service to which the car is put.

To bring up a specific instance, it seems ridiculously inefficient to have a high-powered town car if this vehicle is never used over the country roads. It is of course true that the man who can afford a high-powered town car and who does not use this car at all for country work can generally afford to pay for the inefficiency. Nevertheless, this is a wrong attitude for the engineer to take. It is well known that with a gearbox particularly worked out to suit the case, just as large a car could be handled satisfactorily in traffic with probably one-half the piston displacement. Correspondingly with the reduced piston displacement, not only the first cost of the car but its upkeep would drop far closer to the minimum.

The selection of gear reduction is one of the important factors in locating the position of the engine torque curve in relation to car speed. Given a characteristic torque curve of any engine, the greater the gear reduction the more that torque curve is carried into the lower speed ranges, or, to interpret in terms of car use, into the ranges of city and traffic driving. The point is that when a man never travels above 20 or 25 m.p.h. it is not good engineering to give him a car giving best performance at 30 or 35.

Detroit for Aviation

CASTING about for a location for aeroplane activities, government officials can hardly fail to be impressed with the desirability of Detroit for such operations. This city is almost perfectly adapted to training and experimental work. Its location, bordering on calm waters, in the center of level country, free from dense forests, and with a fairly stable climate, makes it worthy of thorough consideration.

European aeroplane warfare practice is usually performed over water to allow the pilots to see where their bullets strike when fired at floating targets or balloons in the air. The water surrounding Detroit will allow practice at this work.

Furthermore, Detroit is a most valuable city from the mechanical and laboring standpoint. Within its areas there are more men trained in the care, operation and manufacture of engines than in any similar locality on earth. There are mechanics, pattern makers, wood workers, engineers, and combined with these the greatest accessory plants, body factories and motor plants in the world.

Standardized Gasoline

THE movement started in Detroit to have a standard for gasoline is one which should spread all over the country. It is a movement which is indorsed by the car user as well as by the oil man. The standard fuel as arrived at by a recent representative committee would have 20 per cent of its content boiling at 220 deg. Fahr.

When an automobile owner drives up to an oil and gasoline station now he does not know what he is getting. If he asks for information he is told in terms of Baumé or specific gravity. This, we know, means nothing and hence the owner remains absolutely ignorant of the fuel that is being supplied him until after he drives away and it has time to reach his carbureter.

With the adoption of a standard scale which indicates the percentage of the gasoline boiling away at different temperatures and perhaps the temperature of finishing or 100 per cent evaporation, matters would be a long way toward being made clear.

Military Truck Specifications Issued

Military Board, with Assistance of S. A. E., Greatly Improve 1916 Specifications—Twelve Main Essentials Which Do Not Unduly Limit Originality of Engineering

By A. Ludlow Clayden

SPECIFICATIONS for 1½ and 3-ton motor trucks for the use of the army were issued April 12 and were reprinted in full on pages 792 to 804. They are a great improvement over those given out last summer and all concerned in their preparation deserve the heartiest congratulations for completing a very fine job. Full account has been given to experience on the Mexican border, full account to what our manufacturers know from experience of the trucks they have sent to Europe. No available information seems to have been neglected, and while the present specification may not be ideal there can be no question that it is a thoroughly good one.

As a whole the specifications are very free from "fussy" detail, in which they are a great improvement upon those issued last summer. They provide a truck which is entirely commercial except in a very few particulars, and those are such that the alterations would be simple. Take the large radiator for example. This would not be good for conventional service, but it is easy to design the truck to take either the military radiator or a smaller one. So with other parts, that which is uncommercial can be provided for, even if not supplied to the commercial customer.

Following some such procedure as this would permit a truck maker to change over from his standard to his military type in days instead of months. Meanwhile the specifications are drawn so widely that twenty trucks could be built to fill them and yet not be by any means the same truck. Maximums and minimums are used at many places, giving plenty of room in between. The twelve features in the middle of this page are the absolute essentials and it is made fairly clear that departures from them will not be permitted. In most other respects, however, the specifications are quite elastic enough. For example, the form of final drive may be chain, worm, internal gear or double reduction gear; the only requisites are the clearance of 9¾ in. and that all parts must be fully inclosed and lubricated, thus cutting out exposed chains or gearing.

Similarly the wheelbase is not defined exactly, but the limitations are space for a 10-ft. body and a turning circle of 55 ft. Wheelbase should be not less than 124 nor more than 150 in.

Military Truck Essentials

1—*The lowest gear ratio must be not less than 40 to 1. It must be very much lower than is usual or commonly desirable on a commercial truck.*

2—*A large engine, 314 cu. in. for the 1½-ton and 414 for the 3-ton.*

3—*Four-speed transmission, direct drive on high gear.*

4—*The ground clearance not less than 9¾ in. under the axles and all parts thereof, such as the steering knuckles, with a much higher clearance at the center between the axles. Here 18 in. is desired so that the center cannot touch if both front and rear axles are in holes.*

5—*Demountable tires only will be accepted, all of 36 in. diameter, and of specified widths.*

6—*A special gasoline tank is necessary.*

7—*The electric lighting system is elaborate and defined in detail. It includes a searchlight.*

8—*The engine must have three-point suspension.*

9—*Some form of locking differential must be provided.*

10—*Only the best quality alloy steel may be used for the springs.*

11—*The tread varies from 58½ in. to 61½ in., according to the size of tire. This must be adhered to and specified in detail.*

12—*Cooling water must be pump-circulated; the radiator must be of the fin and tube type, while the minimum amount of radiating surface is defined in terms of the size of the engine. This means a very much larger radiator than is demanded by commercial practice and is to care for continued running in sand or on mountain grades.*

A requirement which is of vital importance is the load capacity. Nominally, for a 1½-ton truck, it is stated that the pay load should be estimated at 4000 lb. to allow for the rough usage likely. The body allowance is 1050 lb. for the standard army body, while three men and truck equipment total 725 lb. This makes a total load on the chassis of 4775 lb., or 1000 lb. more if the pay load is taken to be 4000 lb. instead of 3000 lb. Thus it would, perhaps, have been more fair to have called it a 2-ton truck. The chassis weight is limited to 6000 lb.; so the whole vehicle when loaded would have a maximum weight of 10,775 lb. For two-wheel drive trucks it is further desired that of the weight of the pay load not less than 80 per cent nor more than 95 per cent should be on the rear axle.

One of the points about which the hottest argument has raged is that of governing. The trucks sent to Mexico mostly had to have the governors removed because with them the engine could not be accelerated enough on low gear to pull out of the sand holes. Without the governor, however, the speed on high gear was destructive. In the original specifications drafted last year 14 m.p.h. was the limit set; now it is raised to 15 m.p.h., with the proviso that the engine speed must, at the governed speed, be such that the requisite power on low gear is still available. This is still further made evident by the clauses which define the minimum tractive effort at the rear wheels which will be accepted on both high and low gears. Practically, it might be said, that the torque curve characteristic of the engine is held within fairly fine limits by the specifications taken as a whole.

Herein the specifications introduce a rather novel phrase, that of the "Tractive Factor." This factor is the result of dividing the tractive effort at the contact of tire and road by the total weight of the loaded vehicle. It must be not less than 0.0775 on high gear, nor less than 0.338 on low gear.

Lubrication must be by pressure, with an oil pump delivering 30 lb. as a minimum at 800 r.p.m. The arrangement of valves is not limited; they may be set in L, T or overhead fashion, but, whichever the kind of cylinder, they must be completely inclosed. One detail noticed is that laminated shims must be used

and not the old-fashioned type. For pistons iron only is acceptable, and the nature of this iron, together with that for the cylinder casting, is defined. The piston rings must be S. A. E. standard; in fact almost every one of the immense list of S. A. E. standards that are applicable seem to have been adopted. All the steel specifications, the details of heat treatment, and many other like subjects are dealt with by referring to the S. A. E. standard.

Dust Extractors

Mexican experience is seen in the demand that both main and auxiliary air intakes to the carbureter, and also the crankcase breather, be fitted with dust extractors. These must not require water, must be effective, must be easily cleaned and yet not require very frequent cleaning. The raw materials are particularized rather minutely, but in such a way as not to limit design very much.

Apparently the army expects to get good gasoline, for the limitations placed upon the ability of the carbureter are less than those found in commerce. Gasoline with a starting point of distillation 122 deg. Fahr., a 90 per cent point of 350 deg. and an end point of 400 deg. must be utilizable, say the specifications, but much of the gas we are buying to-day is much heavier than this, with end points of 450 or higher and a 90 per cent point around 400.

The gasoline tank must hold 30 gal. and a partition must be used dividing the bottom half of the tank into two, so that at least 6 gal. is retained on either side of the partition. A three-way cock allows fuel to come from either side, but whichever is in use the reserve will still remain at 6 gal. Either gravity or pressure feed is permitted, the limitation being that the fuel must feed freely when the truck is climbing a grade of 25 per cent or worse and with a minimum amount of gas in the tank. Practically this would seem equivalent to demanding a pressure feed or something of a similar nature.

There must be dual ignition, magneto and battery, but one distributor in the magneto and, of course, one set of spark plugs will be accepted. A generator is called for, and also provision must be made for mounting a starting motor, and the flywheel must have the gear ring ready for the starter, but a motor is not to be fitted as standard. For the magneto a standard coupling and mounting with a strap for holding the machine in place must be used, and a drawing is issued with the specification showing dimensioned details of this. The purpose is, of course, to make the magnetos interchange readily from truck to truck. It is specified that the drive for the magneto be such and the couplings so arranged that such interchange is facilitated.

Single-System Wiring

For wiring the single system is to be used throughout, except that the dash lamp and tail light are to be in series. There is to be a 10½-in. searchlight mounted within the driver's reach, adjustable to any angle and supplied with a 21-cp. tungsten bulb, quite a powerful sort of a spot light in fact. In addition combination oil and electric sidelamps and a trouble lamp are required.

For clutch a dry disk pattern with one or more disks is specified and unit power plants will not be accepted. The four-speed transmission must be mounted separately and the interconnection so arranged that the clutch can be removed completely without disturbing engine or transmission case. It is further stated that there must be two universal joints in the clutch coupling and these must not be fabric or leather disks. Gear shift for the four speeds must be in accordance with the S. A. E. standards, as must the other details of the control, but nothing is said as to whether the steering wheel be right or left. The S. A. E. standard provides for brake and gear levers on the driver's right, irrespective of the wheel position.

Brakes have a good many paragraphs devoted to them. The fact is that it is almost impossible to make truck brakes large enough to give as good service as those on passenger cars, so great stress is laid on facile adjustments which must not need special tools. The emergency brakes must be on the road-wheel drums, but the service brake may be either on the wheels or the transmission. There is a somewhat severe clause asking that either of the brakes be powerful enough to slip the wheels or to bring the truck to rest within 50 ft. when running on macadam at 15 m.p.h. There is nothing said as to the length of grade down which the brakes must hold without artificial cooling, a matter that was much argued at former meetings when discussing the old specifications.

A very interesting point is the selection of demountable tire equipment, because this is made after much experience and with an eye to the longest service without changes. The 1½-ton truck with two-wheel drive is to have 36 by 4 single, solid, demountable tires on the front wheels and single, solid demountables 7 in. wide on the rear wheels. Four-wheel drive trucks are to have 36 by 6 in., front and rear, but again single tires and not duals. In the 3-ton specification, which is but a short appendix to the 1½-ton, specifying the differences, the tires called for are 5-in. single front and 36 by 5-in. dual rear. For the attachment of the demountable tires a standard drawing in accordance with S. A. E. practice will be issued by the war department.

Tire Diameter

For both sizes of truck there is only one tire diameter, 36 in., and only four different sections, 4, 5, 6 and 7 in., covering both two and four-wheel drives, making stock-keeping very simple.

There is no need to recapitulate further; the main points have been dealt with and the specifications themselves may be studied for minutiæ.

Of course there is opportunity for criticism; the writer, for instance, regrets the poppet valve limitation because the Knight engine has done so splendidly in European truck service; but to pick to pieces the specifications in detail would serve no purpose, and from experience of the meetings last summer it may be said with conviction that there is not a clause in the whole series which has not been fully thrashed out in discussion.

Next year, for 1918, the specifications are to be revised, and yearly revision is intended. Possibly the requirements may be made more stringent, possibly the freedom given will be increased, but the present specifications do seem to embody as essentially vital points all those things which really make for reliability and convenience in army work, leaving the detail fully to the engineer and manufacturer. One thing is very clear. The United States army truck has got to be a high-grade production and cost will have to be a secondary consideration in preparing its design.

Complete U. S. Army Truck Specifications
Appear on pages 792 to 804

Must Train Military Truck Drivers

No Reliance To Be Placed Upon Commercial Drivers or Chauffeurs —Discipline Most Important—More Trucks Than Drivers

By A. Ludlow Clayden

SHORTAGE of drivers rather than shortage of trucks for the army is a very serious problem.

It is a fact that drivers of commercial vehicles are not to be relied upon and it is also a fact that many of these are leaving their jobs for fear of being called to the colors.

The army to be raised will need a prodigious number of disciplined drivers; for example, one division can easily employ 1500 trucks and needs at least 1600 qualified drivers for them. It is of paramount importance that means for training drivers in a proper military manner be provided without delay.

Trucks can be produced far more rapidly than drivers and we have not yet established any real machinery for recruiting, training and instructing men to become fit handlers of military vehicles.

It would be natural to assume that one of the smallest troubles in organizing automobile transport for military work would be to obtain an adequate supply of reliable drivers, yet it proved a hard task in France and gave a good deal of trouble in England, while there are already indications that there is going to be trouble here.

There are several reasons for this. First, the average driver of a passenger car is not a very good driver, not much use in emergencies. It needs a good many years of driving before one is ready for anything. Far more so is this the case with trucks because the average truck operates on city streets where it cannot get into serious road difficulties and where it is never any distance from skilled help. Only a very small proportion of truck drivers ever acquire "road wisdom."

There is yet another thing to be considered, which is that there is no excess of drivers, rather on the contrary, in business life. The demand for drivers at present is greater than the supply, and this means that employers are being forced to take men they would not choose were the labor market conditions less stringent in this particular.

France Used Soldiers

France found very serious difficulty indeed in getting drivers for her army motor equipment. Men who had been drivers eventually proved rarely to be as good as military trained men who had perhaps never sat in an automobile till they went to the war drivers' school to be taught. W. F. Bradley has told us how farm laborers rapidly became good drivers, because their teaching being part of the military discipline they would do as the instructor directed and were free from possibly bad habits of their own.

England had one good source of supply in the London bus drivers. They were accustomed to working on schedule, had acquired the habit of a strict discipline, and though a trifle rough on their machines their skill in handling heavy vehicles was of a high order of merit. Still they were only a few out of the total needed. At the start of the war any man who said he could drive was given a chance, and if he got through a very brief test he was sent off to the front within 48 hr. The writer well remembers seeing one of these men showing off his handling of a 3-ton truck. He drove successfully round a field, through some narrow places between other trucks and the inspectors were agreed that he was all right. Returning to his starting point he suddenly lost his head, jammed open the throttle and crashed into a new Sunbeam officer's car, piling it up on top of a truck in front and doing $5,000 damage in 5 sec., yet he almost got sent out as a passed driver.

This means that the taking on of drivers for the United States Army ought to be handled with very great care, and the examination should be a stiff one. Nor is it enough to have a man drive a few hours; his acceptance ought to be final only after he has been at work long enough to have settled down to normal. By this is meant that a man can key himself up and drive well for a day or two by exercise of effort of will, but he is liable to a relapse unless driving is already second nature.

Must Obey Orders

In choosing men for drivers it is far more important to pick those who will obey orders willingly, men who expect to be told what to do and when to do it, than it is to seek for mechanical knowledge. Few men with any real mechanical knowledge are content to be truck drivers, and the truck driver who thinks he knows a lot is liable to be extremely dangerous once he gets loose with a box of tools. The military driver ought not to have to touch his machine if the maintenance department is organized properly, and some of the very best French drivers have little more mechanical ability than suffices to change a spark plug.

Just as the army can place no reliance upon commandeered vehicles, except in severe emergency, so they cannot rely upon drivers who have had any less military training than the regular enlisted man receives. Soldier first, driver second, is a rule never to be broken if it can possibly be helped.

Recapitulating the chief points in W. F. Bradley's article on training drivers, which appeared in THE AUTOMOBILE for Aug. 10, 1916, he stated that a truck driver for operating in convoy or train can be trained in 15 days, using absolutely raw material. To produce a capable passenger-car driver it takes from 6 to 8 weeks.

In the French training school the pupils are divided into classes of about twelve each, and these are instructed on a partially torn-down chassis for the purpose of getting into their heads sufficient mechanical knowledge. Next, the instruction in gear changing is given on a jacked-up chassis, with the engine running. After that, tire repair and changing are taught.

On the road, a 5-mile circuit is laid out on level road with many corners. In covering this each man is constantly made to turn, reverse, stop, start and shift gears. Four at a time go out on the driving lessons, taking turns driving.

Past this stage, the men are put on fast machines and taken over hilly routes. Night-driving tests without any lights have to be passed, and each man is supposed to spend a period in the army repair shops.

Hauling a 305-mm. gun along a rough mountain road on the Italian front. Note mixed traffic

Successful Army Trucks

Italian Industry Output Exceeds Army Needs—Differences from U. S. A. Practice—Staff Car Organization and Operation

By W. F. Bradley

EDITOR'S NOTE: This keenly analytical article reflects the comprehensive observations of Mr. Bradley, special representative of THE AUTOMOBILE with the allied armies, on the mechanical features of trucks and cars in Italian army service, with comments on their practical value.

ITALY is the only allied nation in the war self-sufficing in the matter of automobiles. Unlike England, France, Belgium, Russia and Portugal, the Italian Government has not bought a single American or other foreign automobile for war purposes. There are some American cars serving with the British Red Cross units in Italy; also there are a few French, English and German automobiles being used as staff cars or in service with the Italian Red Cross. These, however, were already in the country and have been requisitioned since war broke out. Not only can the Italian automobile industry supply all its army's needs, but it has a very important surplus for the Allies.

This state of affairs is not primarily due to the fact that Italy has an important automobile industry, but has been brought about by a plan which left the industry undisturbed when war broke out. It is quite likely that France could have been as independent had the Allies premeditated this war as much as Germany would like the world to believe. But Italy was in the fortunate

Characteristics of Italian Army Automobiles

TRUCKS

Make	Load	Motor	Drive	Wheels	Tires
Fiat	3½ tons	3.9 x 7.08	Chains	Cast steel	Twin solids
Fiat	3½ tons	4.3 x 7.8	Chains	Cast steel	Twin solids
Fiat	2½ tons	3.5 x 7.08	Chains	Cast steel	Single solids
Fiat	1½ tons	3.9 x 5.5	Shaft	Disk steel	Twin pneumatics
Fiat	1 ton	3.1 x 5.5	Shaft	Disk steel	Twin pneumatics
Scat	3½ tons	3.9 x 5.9	Int. gear	Cast steel	Twin solids
Scat	2 tons	3.5 x 5.5	Shaft	Wood	Single solids
Lancia	1½ tons	4.3 x 5.1	Shaft	Disk steel	Twin pneumatics
Spa	3½ tons	3.7 x 4.8	Chains	Cast steel	Twin solids
Spa	2½ tons	3.9 x 5.5	Chains	Cast steel	Twin solids
Spa	1½ tons	3.3 x 5.5	Chains	Cast steel	Single solids
Diatto	3½ tons	3.7 x 4.8	Chains	Cast steel	Twin solids
Diatto	2½ tons	3.5 x 7.08	Shaft	Cast steel	Single solids
Diatto	1 ton	3.1 x 5.5	Shaft	Disk steel	Twin pneumatics
Isotta-Frasc.	3½ tons	4.3 x 7.8	Chains	Cast steel	Twin solids
Itala	2½ tons	3.5 x 5.5	Shaft	Cast steel	Twin solids
Bianchi	3½ tons	3.7 x 5.5	Shaft	Cast steel	Twin solids
Bianchi	1½ tons	3.5 x 5.1	Shaft	Disk steel	Twin pneumatics
Nazzaro	1½ tons	3.9 x 5.5	Shaft	Disk steel	Twin pneumatics

TRACTORS AND SPECIAL GUN CARS

Make	Motor	Drive	Wheels	Tires
Fiat tractor....	5.1 x 7.8	Chains	Cast steel	Steel rear, rubber front
Spa gun car...	3.9 x 7.8	Chains	Cast steel	Twin solids
Aratrice tractor	5.1 x 7.08	Chains	Cast steel	Steel
Soler tractor....	Single cyl.	Chains	Cast steel	Steel

Traffic policemen examining wreckage of a shelled Fiat. The author, W. F. Bradley, was only 50 yd. ahead of this machine when the shell burst

position of coming into the war at her own time and having the experience of her Allies as a guide. Thus she speeded up her automobile factories and left them at their ordinary work, while all her neighbors had to go through a revolution involving the stripping of the factories to meet the army call for soldiers and a reorganization of the plant to meet the new conditions.

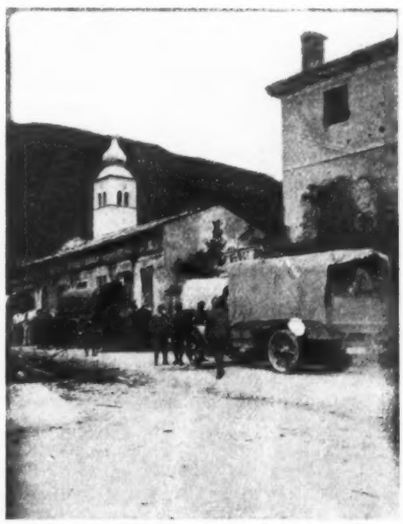
The Italian automobile industry comprises the following factories:

Firm	Product	Plant in
Fiat	Trucks and touring cars	Turin
Lancia	Touring cars, light trucks	Turin
Bianchi	Trucks, touring cars, motor cycles, bicycles	Milan
Itala	Trucks and touring cars	Turin
Spa	Trucks and touring cars	Turin
Scat	Trucks and touring cars	Turin
Isotta-Franchini	Trucks, touring cars, tractors	Milan
Diatto	Trucks and touring cars	Turin
Nazzaro	Touring cars and light trucks	Turin
Zust	Touring cars	Milan
Rapid	Touring cars	Turin
Soler	Tractors	Milan
L'Aratrice	Tractors	Milan
Alfa	Touring cars	Milan

Compared with England, which has in her army every known make of automobile, or with France which employs all her home makes and a large number from America, the situation of Italy is ideal. From Turin to Gorizia or Monfalcone—extreme points of the front and advanced a considerable distance in the enemy's territory—is not more than a 20-hr. automobile and railroad journey. The army has the whole of its automobile factories right at its back, thus securing prompt shipments, a ready supply of spares and simplifying the keeping of stocks to a wonderful degree.

Another factor in Italy's favor is that she has no poor makes. Examining the product purely from an engineering standpoint, there is far less difference between the best and the worst in Italy than in any other country producing automobiles. It will not be attempted to produce a list in order of engineering merit; it is sufficient to say that the list would not necessarily coincide with the output list, for some of the medium and smaller firms are doing the highest class of work.

Only one Italian automobile firm has disappeared since the war, namely, the Aquila-Italiana at Turin; the Nazzaro Co. has passed into new hands, but Felice Nazzaro remains with the old concern. Fiat rightly heads the above list with probably 50 to 60 per cent of the total output of the Italian automobile factories, and has produced more war automobiles than any firm in the world. The firms in the list are approximately placed in order of importance (volume of business), though it is not maintained that the list is absolutely correct. It will be noticed that the factories are all in two towns, Turin and Milan, which cities are very conveniently situated for supplying the armies in the field.



Roadside scene 1 mile behind the firing line, showing the motor and horse-drawn vehicles

Little Difference in Design

The situation is even more simple than appears from an examination of the list; for instance, 3½-ton trucks are made first and foremost by Fiat, followed by Scat, Spa and Bianchi. Some of the others, of course, produce trucks of this carrying capacity, but they are almost negligible quantities. Trucks of 1½-ton carrying capacity are largely specialized in by Fiat and Lancia. Army bicycles are all produced by Bianchi.

The Italian industry is such a close corporation that there are not the differences in design to be found in America, England or France. Several of the makers broke away from Fiat, although independent Fiat influence can still be traced. In the manufacturing centers everybody knows what his competitor is doing, with the result that it is impossible for anybody to get away on a new and successful idea without the rest following.

As a consequence of the closeness of the industry, the army types are fewer and more uniform than in other parts of Europe. The biggest truck employed on the Italian front carries a useful load of 3½ tons. There were 5-tonners made before the war, but none are employed by the army. Experience has shown that the 5-tonner is too heavy for work on the Italian front; this also confirms the experience on most portions of the French front. There is an almost complete absence of trailers, contrary to the practice in France. The explanation is that at practically every point of the line the Italian army is in the enemy's territory and working in hilly country where roads are good so far as surface is concerned, but narrow and winding. The French, on the other hand, are well inside their own borders and have a perfect set of highways.

There are certain features common to all Italian army trucks. They are motor under a hood, platform body with movable sides, four-speed gearbox, and either inclosed chain or internal gear drive, the former greatly predominating. Cast steel wheels are in a huge majority, and practically all trucks have rubber tires. There are a few trucks running with steel tires, but they appear to be old models in service long before war was declared. The use of metal wheels is very pronounced. If pure touring car types are put aside, not more than 10 per cent of Italian trucks are running on wood wheels. The 3½ and 2½-ton trucks have cast-steel wheels, while the 1½ and 1-ton models are fitted with steel disk wheels and pneumatic tires—single in front, twin at the rear.

The piston displacement of the 3½-ton trucks varies from 270 to 400 cu. in., the average being about 320 cu. in. In every case they are L-head castings with partial or complete force-feed lubrication, pump cooling, magneto ignition, governor on the throttle, and integral intake manifolds. Gasoline is always under pressure at the rear, neither gravity nor vacuum being employed on trucks. Metal dashes are general, usually being a steel stamping, but in some cases an aluminum casting. There is some variety in clutches, but all are of the disk type, the leather cone being unknown. Final drive by side chains in a metal housing also forming radius rods is in an immense majority, for it is used exclusively by Fiat and Spa. An alternative system is internal gear drive employed by Scat. A considerable use is being made of cast iron for the upper half of the crankcase, the casting being sand-blasted and finished to give the appearance of aluminum. Base chambers are always cast aluminum, as are timing-gear and governor housings and fans.

TRANSPORTING RESERVE TROOPS TO THE ITALIAN FRONT
One of these 3½-ton motor trucks accommodates from twelve to fifteen men

The 2½-ton models have the same general features as the 3½-ton truck, the engine varying from 210 to 270 cu. in., the motors having four cylinders block cast. The four-cylinder motor predominates in the Italian army, and with the exception of some of the special tractors cylinders are block castings. One of the important differences of the 2½-ton type is the use of single, solid tires, generally of 140-mm. section, compared with twin solids of 120-mm. section on the larger type. A 2½-ton load can be carried satisfactorily on a single 140-mm. tire, thus avoiding one objection to twins, namely, the picking up of stones, which become wedged between the two and do a considerable amount of damage to the rubber. This is a defect which applies to twin pneumatics with even greater force and has been dealt with in more detail in another article.

1½-Ton Truck Unlike Larger Types

The third type of truck is the 1½-ton model, which differs in every respect from the larger vehicles. A few months ago THE AUTOMOBILE published specifications of a 1½-ton army truck which, strangely, was to be everything that the Italian truck is not. The American truck was to be a 14-m.p.h. vehicle with 300-cu. in. motor, dry disk clutch, torque and radius arms, cast-steel wheels with single and twin solid tires of 36 by 4 in. The Italian army makes use of an immense number of 1½-ton trucks having a four-cylinder motor of 270 cu. in., fitted with twin pneumatic tires, officially running at 20, but generally running as fast as 30 m.p.h. These trucks do entirely different work from that given to the 2½ and 3½-ton vehicles. They operate in small convoys, taking up small ammunition and food, and are also used for the quick removal of troops from one point to another. A body very similar to that of the larger trucks is used, and as it is light it enables a load of twelve to fifteen men to be carried.

It is worth while comparing the specifications of the proposed 1½-ton American truck with those of the Italian vehicle. In the first place there seems to be no use for a 14-m.p.h. vehicle carrying such a small load as 1½ tons. Even in the mountain districts and on the bad roads close to the lines there appeared to be no necessity for a slow-speed vehicle carrying less than 2½ tons. Below this was required a vehicle for rapid transport, and a 1½-ton about filled the bill. One-ton models were tried and not found satisfactory. The American specification calls for 300 cu. in. as a *minimum;* in Italy it is a *maximum.* The two types are similar as regards number of cylinders, valve location, main bearings and oiling. The use of battery ignition for starting does not appear necessary. There is not a starting battery in the Italian army, and hundreds of vehicles in the French army have had their batteries removed, so as to rely entirely on the magneto. The specification is in agreement with Italian practice as regards pump water circulation and drain off, but Italian experience has showed that a flat belt gave just as good service as the V type. Naturally, easy provision for tensioning has to be provided. There is agreement on four speeds and reverse, but not on double universal joints for propeller shaft. The Italian practice is a single universal. Hotchkiss drive is not used in Italy. Rear axle is bevel or spiral bevel, and not worm or double reduction. Steering knuckle tie rods are located behind the axle, which is undoubtedly the correct position. It has already been said that the Italian conception comprises pneumatic instead of solid tires. Another distinctive feature is the use of steel disk wheels of detachable type. These are ideal for war purposes; after experience of all kinds under conditions right at the front, the writer unqualifiedly favors the steel disk.

Lighting Practice Not Like U. S.

The electric lighting specifications of the American truck is not in accordance with Italian practice; nevertheless it is good. Practical experience shows, however, that a tail light is perfectly useless. The Italians adopt pressure feed gasoline, as recommended in the American specifications. An auxiliary hand pump on the dash is fitted and is really necessary, for connections are always liable to leak, and the pressure system as a whole is very unsatisfactory. Italian cars do not carry

one-tenth of the spares mentioned in the American specification, and it is doubtful if any army vehicle anywhere in Europe has such a wealth of parts. Under war conditions if so many parts were given out they would either be lost or stolen within a few days. The provision of 2 gal. of lubricating oil is good, but there is no Italian car carrying 8 gal. of water outside the radiator. Most of them have no spare water supply and drivers do not realize that they are in need of it.

No Steam Vehicles Used

Except on rails, no steam is made use of in the transport system of the Italian army. Four-wheel drive tractors are also absent. Very heavy haulage, particularly the removal of big guns, is done by three makes of gasoline tractors which were in existence long before the outbreak of war. They are the Fiat chain-drive tractor with a four-cylinder 5.1 by 7.8-in. engine, equipped with solid rubber tires on the front wheels and steel at the rear; L'Aratrice, a four-cylinder low-built agricultural tractor developed for military work; and the Soler, a single-cylinder double-piston tractor with six speeds and final drive by side chains. The Fiat and the Soler carry some load on their platforms; L'Aratrice hauls entirely.

In the early days of the war the statement that ammunition was taken direct to the batteries by motor trucks caused a certain amount of surprise and was regarded as a wonderful exploit even by members of the industry. On the Italian front it is the general practice to supply all the batteries in this way. Indeed, the automobile service does not stop at the line of batteries, but goes considerably ahead of it; automobile ambulances, for instance, working within half a mile of the trenches.

The big guns, by which is meant calibers of 8 in. and upwards, all have their ammunition brought up direct by automobile truck, much of the work going on in daylight. Whether a daylight service is possible or not will naturally depend on local conditions. Usually guns of this size are 6 miles behind the enemy's front positions, and unless the country is very much exposed convoys can go right up to the batteries without any danger of being seen. The only danger lies from aeroplanes. It must not be supposed that ammunition is dumped down at the base of the gun. All around the battery substantial dug-outs are constructed, and in each one of these a certain number of shells will be stored. Very often rails are laid from the dug-out to the gun and the shells pushed up as required on a small bogey.

The smaller the gun the nearer it is to the trenches, the 75-mm. field pieces being only a short distance behind the infantry. Even these guns, however, rely almost exclusively on motor trucks for their supply of ammunition, but convoys do not usually move up until night, and then in complete darkness, the work of driving, unloading and storing the shells being done without so much as the light of a match being revealed. Here again the ammunition is stored in caves so as to hide it from the enemy and diminish the risk from explosion if the opposing batteries open fire. A feature which always excites admiration in the non-professional is the manner in which batteries are concealed. An instance might be given of a stretch of road, about a mile and a half in length, carrying very heavy automobile and horse traffic, by the side of which there were forty guns of not less than 4-in. bore. Hundreds of automobiles passed directly under the muzzles of the guns—sometimes not more than 30 yd. from them—but it is doubtful if any of the drivers, excepting those who had to go direct to the batteries, could have given the exact location of more than a couple of the guns.

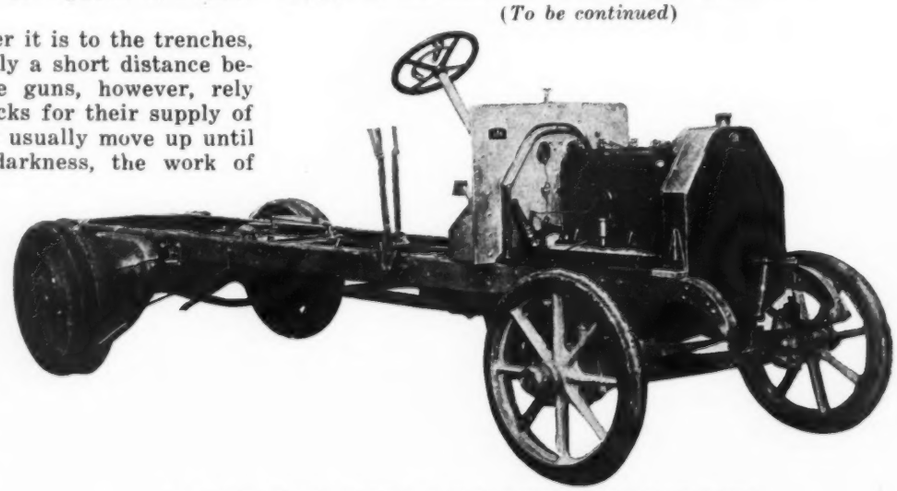
Sometimes a daring gun crew will get a heavy gun practically into the trenches. This is only possible on such a mountainous front as the Italians occupy, for a big gun within half a mile of the enemy's trenches is liable to be spotted, while the bringing up of a supply of ammunition is always a delicate matter. One instance can be given where the Austrians succeeded in getting a 4-in. gun into a trench position 500 yd. from the Italian front-line trenches. This was only possible by hewing a cave out of the rock, running the gun out to fire it, and running it back immediately the shot had been fired. The position might be located to within a hundred yards, but to reply with a direct hit on the gun under such circumstances was almost impossible.

Transportation of Supplies

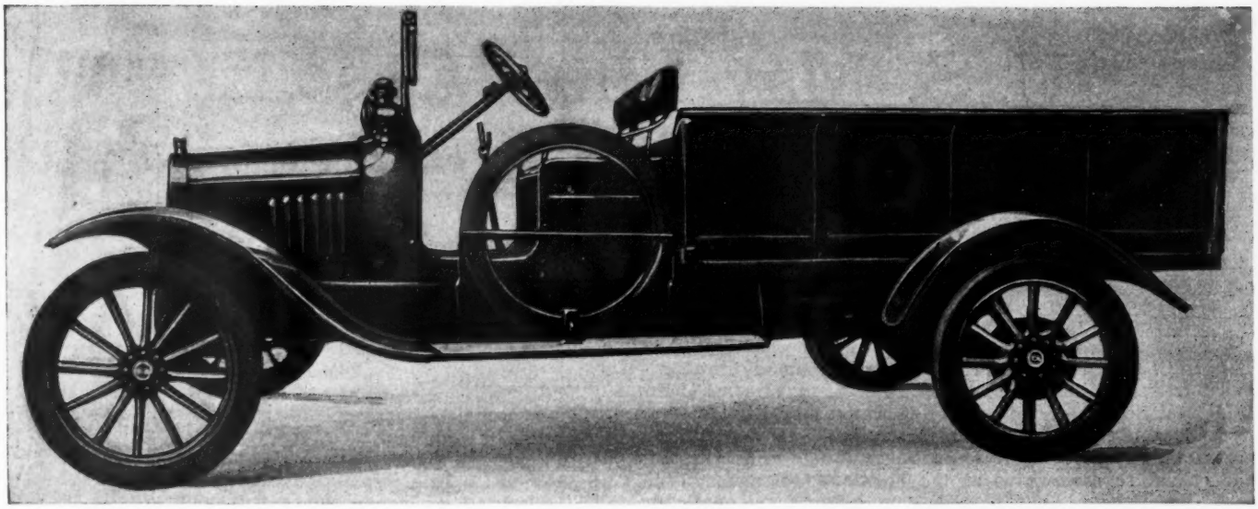
Trench mortars, aerial torpedoes, rifle ammunition and food for the troops in the trenches are all carried up by a combination system of automobile and horse or mule traffic. The bulk of this ammunition will be taken to stores as far forward as possible, and in nearly every case ahead of the artillery, from which it will be moved up under darkness, by means of pack mules or light carts. The final distribution to the men in the trenches cannot be economically undertaken by automobile, for not only are there no roads, but the country may be under rifle fire, and supplies should be distributed as much as possible to avoid loss.

Mountainous country makes impossible the employment of huge masses of troops such as are commonly engaged on various parts of the French front. Also it makes railroads impossible, and gives additional importance to roads and road transport. The height at which artillery can operate depends almost entirely on the nature of the roads, for while a mule can climb up a mountain side with rifle and machine-gun ammunition, it is difficult, if not impossible, to get material to the big guns if the mountain roads are not fit for automobile traffic. Up to 4000 ft. the roads can be kept clear of snow during nearly all the winter, and automobiles can take up a supply of ammunition direct to the guns.

(To be continued)



Spa 3½-ton chassis which is typical of Italian motor truck design



First photograph ever published of the new Ford truck. It is expected that deliveries will start in September and that the price will be close to $500

Ford Truck Out in September

Experimental Models on Detroit Streets—Overhead Worm Drive—Price Close to $500

DETROIT, April 13—(Exclusive to THE AUTOMOBILE)—The Ford truck, which has been a matter of the greatest interest to the automobile industry for the past year, is soon to make its appearance. A number of experimental cars are running about the streets of Detroit at the present time, and as soon as a few of the last details are cleared up and the Ford factory has caught up to the demand for its passenger cars, the truck will be out. As the Ford company is over 100,000 cars behind on passenger car work, this will probably be in September.

The experimental body fitted to the present truck is a panel side job. A photograph of the truck is shown herewith, this being one of the cars which have been seen on the streets of Detroit.

The coming of this truck in great quantities promises to stimulate the delivery and light commercial field as it has not been affected in the history of commercial vehicles.

Selling at a price which will be close to $500, this vehicle is put within the reach of practically every small merchant in the country. It is a truck which is adaptable to such a wide variety of uses that to attempt to list them would be next to impossible. The baker, truck gardener, butcher, and all the other tradesmen whose great problem is frequent and prompt deliveries will find in this truck something which the industry has been awaiting for a long time with intense interest.

Will Run on Kerosene

Experiments are being carried on at the present time to determine the possibility of operating this truck on kerosene. These will probably be a success when it is remembered that, as THE AUTOMOBILE told some months ago, Holley carbureters are being shipped to Great Britain for installation on the Ford products in Europe. With a truck of this size operating on a fuel costing from 9 to 15 cents per gallon, and probably running a distance of 25 miles to the gallon, the fuel cost will be relatively very small.

The experimental cars are mounted on pneumatic tires in front and solid in the rear, and this will probably be the case with the finished product.

The power plant is similar to that used on the passenger car. It is a four-cylinder block unit, 3¾ by 4 in., with L-head cylinders. This gives a rating of 22.5 hp. by the S. A. E. formula. It is possible that two or three alterations will be made in the castings for the Ford engine at about the same time the truck gets into production. These will probably be related to the cylinder-head castings, permitting better water circulation in the head and better cooling around the spark plugs. Cooling is by thermo-siphon. The trucks will be governed at a speed of about 18 m.p.h., although this is subject to variation, as some of the experimental trucks which are at present running about the streets of Detroit are not equipped with governors.

Worm Drive Axle

The transmission gearset is the same planetary unit used on the passenger car, the drive being taken from this through a propeller shaft to a worm-drive rear axle, in which the worm is mounted over the gear. The gear reduction at the worm is approximately 7 to 1, being about twice the ratio used in the passenger car. The truck is particularly noticeable for its pressed metal parts and forgings. The wheels are artillery type, and the gasoline tank is carried beneath the driver's seat. Electric lighting will be used on the truck, and in all probability combination oil and electric lamps will be supplied as regular equipment.

U. S. May Label Gasoline

Federal Law Based on Evaporating Qualities of Fuel Outlined as Possible at Mid-West S. A. E. Meeting — Fuel Symposium Brings Out Practical Comments on Acceleration and Economy

CHICAGO, April 16—Possibility of a Federal law which will require the labeling of gasoline as determined by its evaporating qualities was the announcement of Dr. Hobert C. Dickenson, physicist of the Bureau of Standards and Bureau of Mines, Washington, D. C., at the meeting of the Mid-West Section of the Society of Automobile Engineers at the Chicago Automobile Club last night. Dr. Dickenson stated that these two government bureaus, of which he was the official representative at the meeting, had almost completed a standard specification for gasoline and probably would suggest the requirement that all gasoline should carry a label having two figures, one the temperature at which a certain proportion of the fuel, perhaps 20 per cent, will evaporate, and another at which perhaps 90 or 95 per cent will vaporize.

Mock Leads Fuel Symposium

This announcement was made during the discussion of the symposium on the fuel question, which was the feature of last night's meeting and was led by a paper entitled, The Fuel Question from the Driver's Standpoint, by F. C. Mock, engineer, Stromberg Motor Devices Co., and which included authoritative statements from Dr. Burton, vice-president Standard Oil Co. of Indiana; on the fuel situation for the immediate future as well as the discussion of the carburetion problem, the efficient use of fuel from the engine manufacturer's standpoint by H. L. Horning, general manager, Waukesha Engine Co.

The meeting, which was attended by 150 car, truck, tractor and oil engineers and their friends, was preceded by a dinner at the Chicago Automobile Club, tendered by the Mid-West Section to President Dunham and the Council of the Society of Automobile Engineers now in session in Chicago. At this dinner toastmaster Fred C. Glover of the Emerson-Brantingham Co., tractor maker, introduced President Dunham, whose message was that through the society the government is planning to utilize S. A. E. members and that they would best serve their country at this time by awaiting their country's call through the society rather than in a burst of patriotism tie up their efforts in some line of service in which they would not be as useful as that planned for them.

This was brought out more in detail by General Manager Coker F. Clarkson, who told of the very close co-operation between the government and the society in the mobilization of its factory and inventive and organization resources and also of the very successful way in which the society's census of its membership for war work is working out.

F. E. Moskovics of Nordyke & Marmon in a very stirring talk emphasized the need of increasing the membership of the society, stating that the work the society is doing, particularly in helping the country's defense, is out of all proportion to its size; that every one of the 8000 men in the country who are eligible to the society are needed by the government in the organization in which their best work can be done.

Utz Tells of Army Truck Work

Chairman Utz of the Standards Committee told briefly of the co-operation between the quartermaster's department and the society which has resulted in a development of the standard specifications for army trucks detailed on other pages.

In the presentation of his paper Mr. Mock illustrated very forcibly the difference in vaporization of different grades of fuel. He arranged a manometer in which two grades of gasoline and one of kerosene were held under the same pressure by a mercury column and by heating these showed the variation in vaporization and how it affected the operation of an engine.

Discussion Rich in Suggestions

In the technical discussions which followed Mock's paper, both Dr. Dickenson and Mr. Horning took exception to Mock's statement that the vaporization points could not be taken up as a good indication of the value of the gasoline for automobile use. Horning stated that in a series of tests on samples of identical fuels performed in his laboratories at Waukesha and those of the United States Bureau of Standards in Washington there was a variation of only 1 or 2 deg. in boiling point. Horning felt that the volatility test is the only one by which a fuel like gasoline can be judged, and that the main difficulty in it came from not keeping the conditions under control.

Herbert Chase, treasurer of the society, gave it as his opinion that more attention must be paid to developing engines for the use of heavier fuel. In Europe there are tractors operating on fuel much heavier than kerosene with engines of the semi-Diesel types that we have to look forward to using a much heavier fuel in the future.

Frederick Purdy, Findeisen & Kropf Mfg. Co., brought out the fact that car owners must be prepared to sacrifice some feature of car operation and that with present-day fuels and prospects for the future it would be impossible to expect coincident increases in acceleration power and economy that we have had in the past few years.

G. W. Smith, chief engineer, Nash Motors Co., declared that the oft mentioned difficulty of gasoline in the crankcase, to a certain extent, is an owner's question; that it is no hardship to ask the owner to change his lubricating oil every 1000 miles, and that also we have reached the point where the chemists get busy. He also reported on some tests on the use of mixture of benzol and alcohol as giving good results and stated that with alcohol 95 per cent of the power output was obtained and 75 per cent of the economy.

Tractors in Cuba Run on Alcohol

Mr. Glover then brought up the question of the use of alcohol and stated that until war conditions made it impossible all of their tractors in Cuba were operating on alcohol which was made by the individual sugar planters from their refuse at a cost of approximately 8 cents per gallon, as compared with something like ten times that cost for gasoline; that no changes were necessary in the engine except the increase of compression to about 95 lb. per square inch and the fact that cork carbureter floats could not be used because the alcohol ate up the shellac. Mr. Horning then presented an illustrated discussion on the chief problems of engine design from a combustion standpoint and brought out in particular how far present-day engines diversed from the theoretically ideal engine from the standpoint of proper cooling which makes for thermal efficiency.

The earlier parts of F. C. Mock's paper dealt historically with the falling grade of gasoline and also explained the nature of the mixtures which we call gasoline; describing the process of obtaining a distillation curve and reading its meaning. He also spoke a little on manifold design, laying special stress upon the effect of sharp bends in throwing down the gas in liquid form. These subjects have been discussed in THE AUTOMOBILE in an article by J. E. Schipper, in a recent issue. In fact the experiments described by

Mr. Schipper were made in the laboratory of the Stromberg Motor Devices Co., of which Mr. Mock is chief engineer.

The potent effect of throttle opening upon carburetion was discussed in the latter part of the paper as follows:

The percentage of gasoline evaporated and its rate of evaporation depend greatly upon the position of the throttle, or, more specifically, very closely with the vacuum in the intake manifold (this will be shown by experiments at the time this paper is presented). As a result there is little trouble from failure of the gasoline to evaporate at closed throttle. This fact, in conjunction with preceding ones, gives the reason why we have difficulty in handling our present day heavy fuels *at wide open throttle and low air velocity.* This has been helped to a certain degree by preheating the air charge or by heating the intake manifold, but the heavy elements introduced in the gasoline in the last few years are so non-volatile that their complete evaporation requires heating the manifold and entering air *above the boiling point of water,* and to so high a temperature that the amount of air charge, and consequent power of the engine, are perceptibly reduced.

We recently made some experiments by directing an atomized supply of gasoline into a bent elbow, through which air was being drawn, and noting the condition of the mixture issuing from the elbow when the elbow was heated at different temperatures. Though the spray was very fine indeed, so that it would change into a mist and then disappear when the spray jet was directed into the air of the room, in the elbow the action was very bad. The gasoline would strike on the far wall of the bend and drain back out of the elbow in a steady stream, while only a few fine particles would issue from the mouth of the elbow. This was at temperatures of the elbow from 70 deg. to about 220 deg., with the entering air about 70 deg. When the elbow was heated to about 250 deg., conditions were somewhat better, as about two-thirds of the gasoline drops seemed to make the bend without condensing on the wall and there was consequently less "loading" in the elbow. When the elbow was heated to 310 deg. Fahr., there was no condensation whatsoever and the gasoline came out of the elbow in a white smoke or dry fog.

Necessity for Compromise

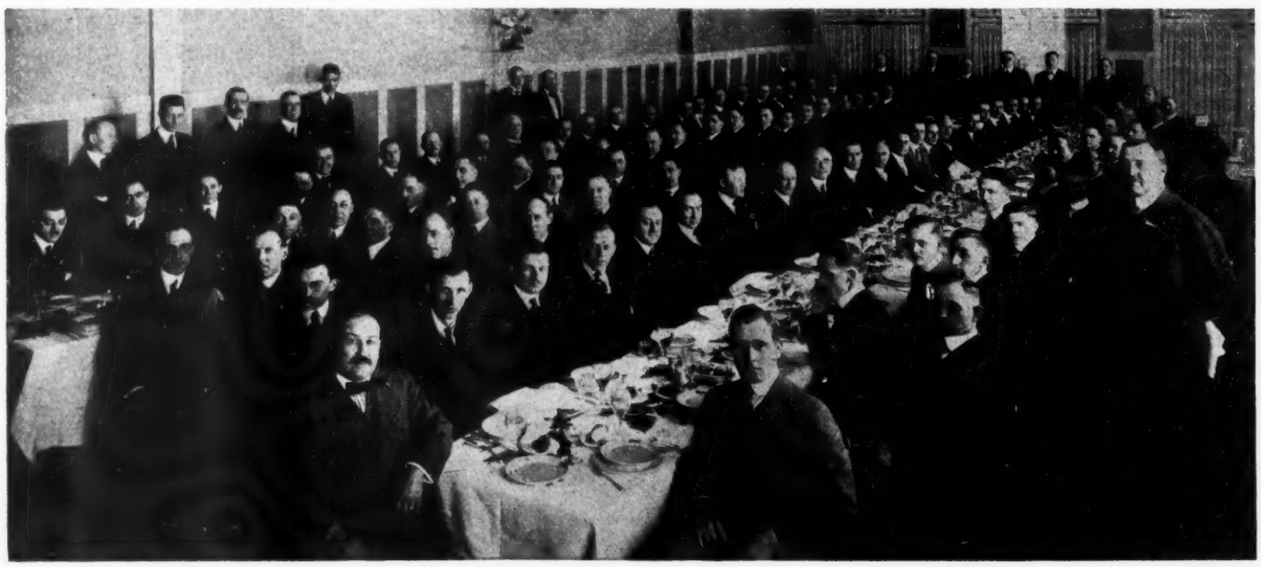
In developing a motor car engine of the type used to-day it seems necessary, for the use of fuel no heavier than that we now have, to choose some compromise among the following:

1. Restricting the torque at high speeds by a small intake manifold, or
2. Heating the charge so much that the power is reduced, or
3. Reducing the range of operation (*i.e.*, providing a range of operation of 5 to 45 m.p.h. at wide open throttle instead of from 1 to 60); or
4. Using light gasoline, which is now expensive, and will speedily become more so in years to come.

Just here is where it is of value to consider the subject from the driver's viewpoint. A number of engineers would rather do anything else than sacrifice their maximum power per cubic inch piston displacement, which it should be noted is *not a satisfactory rating of the power of the motor in the car,* because it applies to but one speed, and that one seldom used. This "maximum power" is extremely different from the maximum power the driver knows, which is usually gaged in the way it is most usually employed, by the torque available for acceleration, at ordinary driving speeds. The motorist also objects to paying a high price for gasoline, or having to go to special filling stations to get a particular kind. I further believe that the average man is willing to shift gears when it is necessary to pull through sand or climb a hill below 7 m.p.h., in fact, he should do so for mechanical considerations alone. To practically every motorist it is of much more importance than many well-known mechanical "talking points" that a car should warm up to a temperature of good running in a few blocks, yet how few are the cars that will do this. There are many similarly logical reasons why, with the fuel situation as it is, we should be prepared to yield some standards of performance in order to realize certain other standards of economical and convenient operation.

Heavier Fuels

There is a large public demand for the use and utilization of even heavier fuels than the gasoline we now have, and this must be attained if motor fuel is to continue at its present price in years to come. Until a very short time ago we have not seen in operation any system which would use kerosene, for instance, without so many disadvantages that it gave no promise for motor car use. In fact kerosene is scarcely satisfactory on motors of constant speed, where there is no limitation as to intake air velocity or as to the amount of heat available. We have recently found that by following a cycle whereby the kerosene is vaporized at a very high temperature, and then mixed with a charge of air at low temperature, that the resulting fog may be kept in complete suspension in the air stream, and this should therefore do away with the troubles above described, so far as they relate to conduction of the fuel to the cylinders. There remains the further difficulty of obtaining a *vapor* in the cylinders, so that the spark can propagate away from the spark plug points, but this can probably be overcome by using a blend, as by mixing the kerosene with some of the elements now found in gasoline; this is also desirable as a step toward economical use of our fuel resources, because such a fuel corresponds more nearly with the composition of the natural petroleum product.



Annual dinner of Mid-West section of the Society of Automobile Engineers tendered the Council of the society at the Chicago Automobile Club, April 16

Spring Suspension Problems

Formula for Period of Pitching Motion—Why Cantilevers May Ride Easily—Cradle Suspension Explained

By N. W. Akimoff
Consulting Engineer

EDITOR'S NOTE—This is a digest of a paper read before the Detroit section of the Society of Automobile Engineers April 16.

THE writer contributed a paper at the annual meeting of the Society of Automobile Engineers in January, 1917, under the title "Remarks on Dynamics of the Automobile." In order to formulate a proper starting point for the discussion this evening, it is desirable to review briefly the substance of that paper, which attempted to present a rational theory of spring suspension, that is, one based on the fundamental principles of mechanics.

The main element covering the success or value of an automobile spring suspension was held to be the numerical value of the linear up and down acceleration experienced by the passengers. Such acceleration may be due to the bodily up and down vibration of the chassis, as well as to the angular oscillation of the chassis in a vertical longitudinal plane.

The latter vibration possesses, in general, a rather high frequency, and the writer, disregarding any other mode of oscillation, sees the solution of the problem of spring suspension in the reduction of this frequency to the lowest value consistent with practical considerations.

An Approximate Formula

The writer submits that, reducing the car suspension to its theoretical skeleton, namely—a beam, supported on its ends by two identical springs, the period of oscillatory "pitching" motion, is as follows:

$$T_p = 2\pi \sqrt{\frac{\delta}{g}} \sqrt{\frac{2k^2}{l^2}}$$

Where T is the pitching period in seconds; d is the initial deflection of each spring in feet; K is the radius of gyration of the beam about its center of oscillation; G is 32.2; and L is the distance between the springs, that is, in an actual car L would be the wheelbase.

It appears, therefore, that soft springs, that is, with a high value of d would give a longer period; but too great a deflection is objectionable on some grounds; we all know that there is a practical limit to the value of d, or the initial deflection of the spring, beyond which the car will "not hold the road." It likewise is clear that, in the simplified scheme under consideration, the value of k should be as great as possible; in other words, we should strive to increase the distance between the center of gravity and the center of oscillation, but *not* merely lower the center of gravity. Some designers seem to feel that this lowering of the center of gravity is desirable, but to this the writer is radically opposed. Analysis of this equation also makes it evident that the wheelbase should be kept down instead of being increased abnormally, which seems to be the present tendency.

Of course, the writer advocates neither the raising of the center of gravity, nor the reduction of the wheelbase to any extent beyond that prescribed by practical considerations. He certainly would not reduce the wheelbase to zero, although this seems to be the way he was almost universally understood despite his very explicit caution to the contrary as made in the original paper.

The formula given above is only roughly approximate and is intended only for guidance as to the relations existing between the various elements entering the problem of suspension.

As regards cantilever springs, the writer states that *if* the cantilever arrangement gives better riding qualities, the reason lies in the fact that the springs are attached more closely to the center of the body, thus giving the same effect as would a reduced wheelbase, that is a slower period of pitching.

It will be seen from the above that the writer's principle is to consider the action of a system which is more or less representative of the working conditions in a real car, instead of considering only one portion of a car, and assuming the motion of this portion to be simply vertical, quite regardless of its connection with the rest of the system. The latter assumption cannot possibly lead to any conclusions of value. Even if the problem is framed in this erroneous way, the writer still feels that the effect of the elasticity of the tire itself has been so far overlooked.

Natural Vibration of First Importance

The tire is a spring, and the two springs super-imposed give a radically different motion from that of a simple pendulum, the mechanics of which seem to be universally considered as covering the problem of spring suspension.

In general, the writer's opinion was stated to be that in the problem of spring suspension, it is the natural and not the forced vibration that is of greater importance and interest. The visible imperfections of the road, such as holes and bumps, which set up noticeable forced vibration, are more or less accidental and, according to the writer, are all of secondary importance as compared to the natural oscillations which often seem to be "picked up" over an apparently well kept road, and which are so irritating to passengers and so damaging to the reputation of a car. To reduce their frequency to something like forty oscillations per minute appears to be the true object of a good suspension.

The former paper, as already has been intimated, appears to have been much misunderstood.

All the suggestions made were proposed in a purely tentative manner, no previous treatment of the subject of spring suspension, to my knowledge, having thrown any rational light on this complex problem. The main objections to the paper cited seemed to have been as follows:

(a) It was objected that the conclusion and the point at issue were not made sufficiently clear. It will be relatively easy to elucidate matters further, in this discussion.

(b) It was objected that the statement as to the effect of cantilever suspension on the pitching period is wrong, the latter being independent of the manner of attaching the springs. I will show that no error has been made in this statement, but that the location of the springs has everything to do with the period of oscillation in the place under consideration, and consequently believe that as a result of this further exposition, it will be necessary to make no correction to the former statement.

(c) It was further objected that no concrete design was suggested but only a few generalizations had been presented. As a matter of fact, it was not my object to suggest any specific design at the time of writing that paper, but only to present a few thoughts which I considered should be borne in mind by those approaching the study of spring suspension. Since then I have had an opportunity to view the matter from a somewhat different standpoint, and now am in a position to suggest at least one concrete and specific design, in accordance with the ideas which I previously set forth in a perfectly general manner.

So far as the problem of spring suspension is concerned, out

of the several ways which an automobile body can vibrate, only one in my opinion is especially harmful, namely—the so-called pitching which consists in a series of oscillations in a vertical, longitudinal plane. It is, therefore, my opinion that all other modes can be safely neglected, and the whole problem of obtaining easy riding reduced to lowering the pitching period to its lowest possible value. I feel that all forced vibrations such as are induced by rolling over stones and bumps are somewhat accidental and do not constitute the main problem of suspension, which, in my opinion, is the problem of obtaining a *sluggish kind of pitching*, irresponsive to all but the very slowest impulses. Synchronism with such slow rates as 40 or so per minute is harmless.

Indeed, by securing such slow periods and afterwards by dampening them out if necessary by friction, or otherwise, a most ideal suspension should be realized. At the present time, however. some engineers seek to dampen out an ordinary quick vibration, with the high period of 120 or so, forgetting the fundamental fact that frictional dampening can change amplitudes, but can only affect periods to an extremely small degree. In fact, frictional dampening, practically speaking, leaves the period of oscillation unchanged, except, of course, in cases where the friction is so excessive that the spring in reality becomes a solid unyielding support.

It appears that many designers are actually trying to depart from the pendular nature of the vibration of an ordinary loaded spring, and are trying to involve more complex modes of oscillation. All this would bring about good results only if the period of such oscillation could be made slower, no other effect of such artificial modes being of any use.

Road-Holding and Riding Qualities

It should also be observed here that the so-called "road-holding" quality of the car is likewise closely connected with the problem of ease of riding, the reason being very simple indeed: the rotating shaft, together with the flywheel, clutch, etc., acts as a gyroscope, and the effect of a high-period oscillation acts on the system as a *forced precession*, with the appearance of an alternating torque, acting in a horizontal plane. We all know how to figure out the numerical value of this couple: it is equal (in feet and lbs.) to $I \Omega \omega$ where I is the moment of inertia of the rotating parts in question; Ω is the angular speed of rotation and W is the angular speed of precession (alternating, of course, at the same rate as the pitching of the body). Consequently, by reducing the pitching period, the value of this alternating torque can be minimized.

So far as the second objection is concerned, I fail to see how anyone can deny the truth of something so evident. Even without going into mathematics anyone can make the simple experiment indicated in Fig. 1 and satisfy himself that a beam supported by cantilever springs in position *a* will oscillate (pitch) at a very much slower rate than when the same springs are mounted in position *b*. Of course the bodily up-and-down oscillation is the same as before, but we are not in the least concerned with the latter, our main problem being *how to increase the pitching period.* I will quote from the former paper: *If the cantilever arrangement gives better riding qualities, the reason lies in the fact that the spring is fastened more closely to the center of the body, thus giving the same effect as would a reduced wheelbase, that is, a slower period of pitching.* Now this is exactly what is shown in Fig. 1, whereby I hope the matter can be settled. It should be noted, however, that I said *if* not *since* the cantilever arrangement, etc., because I do not mean to say that every cantilever spring will always ride better than every other type, as this would be manifestly incorrect.

Coming now to the last objection, namely, my having failed to present a concrete design embodying my ideas, I wish to emphasize the fact that at the time of writing the first paper my intention was solely to present what I thought to be the rational aspect of the problem. If my deductions were of interest or benefit to fellow-engineers, this was the highest reward I could think of; later on, acting on suggestions of many friends, I developed a more or less definite construction, comprising the fundamental ideas of the first paper. By way of illustrating the possibility of incorporating my fundamental ideas into an actual construction I submit Fig. 2, which is merely a rough sketch: here the springs *F* and *R* are comparatively stiff, say 30 per cent, or so, stiffer than in present practice; therefore, this would mean higher frequency of pitching of the sub-frame *S*. On the other hand the body itself is mounted on the special frame *B*, pivotally connected to the sub-frame *S* at *A* by means of a bearing and a cross axle. Now this frame *B* is supported at *C* and *C* by very stiff springs, which may be of either the coil or leaf type, but rather closely located with regard to the vertical plane through *A*. The bracket *K* will of course be a much more elaborate design than is schematically indicated on the sketch; and the point *A* will be located as low as possible, consistent with the prescribed road clearance, for the sake of securing the greatest possible moment of inertia of the car body about its center of oscillation *A* (see the period formula in the foregoing abstract of my first paper).

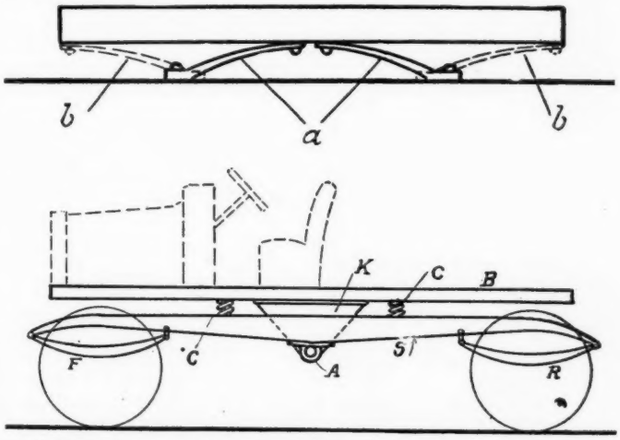
Should Reduce Wheelbase

The wheelbase should be reduced as much as the appearance of the car, the size, the accessibility, etc., will allow, instead of increasing it as is now being done for some reason which no one has ever taken the trouble to clearly indicate in writing. And then the distance *C-C* constitutes the further (and very material) reduction of the effective wheelbase. Combining these features we will have a car which:

1. Will hold the road well, because all the springs are stiff, and the forced precession (see above) is very slow.
2. The period of pitching oscillation will be extremely low, and very inert to undulations on the road surface. Even if pitching does happen to synchronize with the road inequalities, it is so slow that it will be neither unpleasant nor in any manner objectionable to the passengers.
3. Shock absorbers will act well on this suspension, because the period is slow to begin with, and *while* the oscillation is being damped out, the effect on the passengers will be not in the least annoying.
4. The shocks will have a very indirect way of reaching the car body, with many intervening means to minimize their effect.

The natural objections to such a construction would be increase of weight and cost. However, good design together with very material decrease of weight and cost of springs, which can be very short and cheap, will probably reduce this difference very considerably. On the other hand the suspension would give, if properly designed, such material increase in comfort that the objections would naturally lose their importance.

In smaller and lighter cars the sub-frame *S* can be supported by means of cantilever, instead of semi-elliptic springs, somewhat after the sketch in Fig. 1. In such a case it can probably be made extremely short and cheap, while other features of the suspension would be of course maintained as shown in Fig. 2. This principle, I have called *cradle suspension* for want of a better name. It arises in every feature, from the investigation which forms the subject matter of my first paper.



Above—Fig. 1—A beam supported by cantilever springs in position a will pitch much slower than when mounted in position b

Below—Fig. 2—Principle of cradle suspension described by Mr. Akimoff

Church Defines Military Truck

American Conditions Differing from European Call for Other Designs—Experience on Mexican Border Best Object Lesson

By H. D. Church

Chief Engineer, Truck Department, Packard Motor Car Co.

¶ This paper, read April 16 to Cleveland Engineering Society, has been submitted to the War Department, and in reference to it Colonel Baker stated, "I consider it a splendid paper, covering the essentials of the subject; giving an explicit idea of the aim of the department in the development of this truck." It will be noticed that the ideas herein contained agree closely with those of the specifications just issued by the War Department and printed in full on page 791.

MOTOR trucks of American manufacture have played an important part in the present European War, but up to the present time our general design has not been materially influenced thereby.

The conditions on the western battle front in Europe are such that large armies have been practically in the same position for two years, and this fact, in conjunction with the first-class French roads, has made it possible for the conventional design of the American commercial motor truck to render fairly good service.

In other words, the commercial motor truck of to-day is essentially a hard roads vehicle, and when used over such roads would naturally not require any radical changes in design to meet military conditions.

In event of any fighting on American soil at any time for several years to come, it is most improbable that similar conditions to those outlined above would exist. Our borders are so long that permanent trench fighting on a large scale is most improbable, and the roads in this country are far inferior to those of France or Germany. It follows, therefore, that a truck designed for satisfactory military operation in this country, which means for use in connection with mobile field operations over mediocre roads, or in some cases, no roads at all, must necessarily be of a design differing in many respects from our present type of commercial vehicle. Furthermore, the design of such a truck is bound to be influenced by the widely varying climatic conditions found in the United States proper.

During the trouble with Mexico, in the past year, our Army, for the first time, depended almost entirely upon motor transport, using quantities of the leading American makes of conventional commercial trucks.

From the standpoint of quick development of a suitable truck for American Army use, it is most fortunate that the operating and climatic conditions were extreme, as the result was to sharply define those points wherein a truck designed primarily for commercial service would not satisfactorily meet our military needs.

The experience of our Army with motor transport for the past several months has resulted in a vast amount of information as to desirable changes in design, and the Army has been most willing to extend to the engineers of the various truck manufacturers every facility to gather first-hand information on Army requirements for motor transport.

It is the writer's opinion that for American Army transport purposes, several different types of transportation will be required, according to topographical and road conditions:

1. Mule transport.
2. Caterpillar tractors.
3. Four-wheel driven trucks.
4. Two-wheel driven trucks.

Each of these methods of transport will probably be used, as each of them has a certain field of operation which cannot satisfactorily be filled by the other types. It is probable that the majority of the transport work will be done with two-wheel driven vehicles, as, where the road conditions will permit of its passage, this type will haul materials in the minimum time and at the minimum operating expense.

As the writer's direct experience has been largely with two-wheel driven trucks, this paper will be confined to consideration of that type, primarily of a nominal capacity of 1½ tons, this being the size which was most largely used.

Governors Are Essential

One of the first and most important points in connection with the design of a military truck is the absolute necessity for governors, not only to limit the maximum vehicle speed on high gear, but also to limit the maximum engine speed on any of the gears.

Experience along the Border with trucks which had never been equipped with governors by their manufacturers, as well as with trucks on which the governors had been removed to obtain more power, proved conclusively that a governor is even more necessary for trucks in Army service than for those in commercial service.

From personal observations made along the Border, it is the writer's opinion that the constant maximum engine speed governor is the proper type. This type of governor not only keeps the maximum vehicle speed down to a point where durability is assured, but it also keeps the engine speed down at all times, so that it is impossible to shorten the life of the motor by excessive speed when running on any of the geared speeds in the transmission. This is an important consideration for soft road operation where, if a governor which limits only the maximum road speed is fitted, there is a great temptation to the driver to run for long periods on second or third gear in the transmission with the engine racing, a practice which will materially shorten the life of the motor.

Governors must be thoroughly inclosed and sealed, to prevent their being tampered with without the knowledge of those in authority, and in order to obtain the best results, should be extremely sensitive, without "surging." A sluggish governor cuts into the power curve of the motor too early on acceleration and too late on deceleration, and experience has shown that a snappy governor action can be obtained within speed limits of 4 per cent on acceleration and 5 per cent on deceleration, which will utilize the maximum amount of horsepower for a given maximum governed speed.

Conventional Tractive Effort Inadequate

Consideration of governors leads directly to the question of ability or tractive effort, both on high and low gears. To obtain the best results over soft road conditions, and *without* disconnection of governors, the average American commercial truck has insufficient high gear ability and far too little low gear ability to successfully pull its load through deep sand or mud or over extreme grades.

The average truck designed for American commercial service has plenty of ability on both high and low gears to successfully handle its load over hard roads and over the grades found in American cities, but the conditions of operation for Army service in this country are much different.

The tractive effort required increases very rapidly with an increase in road resistance, and sand or soft going will not infrequently result in road resistances as high as 300 lb. to 500 lb. per ton, far in excess of anything ordinarily encountered in commercial service.

When it is considered that the road resistance in pounds per ton on good asphalt is 15, on macadam 50 to 60, and over ordinary cobbles 130, the necessity for an increase in tractive effort becomes very apparent.

For American military purposes, the low gear tractive effort should at least be sufficient to continuously turn the rear wheels of the fully loaded truck on dry asphalt with the truck itself stationary. Using a coefficient of friction between the tires and a dry asphalt surface of .6 and a total rear end loaded weight of 7600 lb. for a 1½-ton truck loaded to capacity, the low gear tractive effort necessary to meet these requirements becomes 4560 lb.

Commercial truck practice now gives far lower figures. For example: The low gear tractive effort of what is considered a powerful 1½-ton commercial service truck is only 2600 lb. To safely carry the low gear torque required to give 4560 lb. tractive effort, the driving members throughout, from the gear train in the transmission clear back to the rear tires, must be made heavier and stronger, which of course will result in an increase in chassis weight. From the standpoint of design, it is probable that any such increase in low gear ability for military service as outlined above will cause more changes in truck chassis design than any other one requirement, the necessity for which became apparent during last year's experience on the Border.

Radiators Must Be Large

The heat dissipating ability of the average radiator was found inadequate, a serious matter at any time, and more serious in a country where water is scarce. With the thermometer standing at 110 to 120 deg. Fahr. in the shade and the truck using maximum power on low gear for long stretches, extraordinary cooling ability is required. Probably an increase of 50 per cent over average commercial practice would not be excessive, and a desirable provision would be simple means for reducing the radiating area for efficient use in the cooler sections of this country.

When a truck is pulling along through heavy sand on low gear, its speed is so slow that the air circulation through the radiator resulting from the movement of the vehicle can practically be disregarded. This means that the radiator fan must handle a large volume of air in order to keep the engine cool under these conditions. In the writer's opinion this is not so much a question of efficient fan design as it is of furnishing some means of driving which will keep the fan up to its normal operating speed. The belts used for driving the fans on the average commercial truck are not sufficiently powerful to properly meet this condition, and either the size or design of belt will have to be changed, or some positive drive provided for the fan.

This is an important point, for if the radiator design is such that it depends upon the fan circulation to give a certain cooling ability, the result is seriously affected if the fan does not at all times draw approximately the volume of air that it handles when its belt is new and tight. A feature of the radiator which should be given careful consideration is its mounting, which should be such as to minimize any strains in the radiator proper which are set up as a result of excessive chassis frame deflection. Furthermore the radiator should be of a type which has large water passages, is least liable to break under distortion, and which is readily repairable in the field.

Four Speeds Desirable

Army experience on the Border clearly showed the desirability of four-speed instead of three-speed transmissions for military purposes. If the low speed reduction ratio in a three-speed transmission is made great enough to give proper low gear tractive effort, the steps between speeds become so great as to interfere with easy gear shifting. Furthermore, the four-speed gearbox has the very important advantage over a three-speed box for soft road service of always having a gear ratio more nearly adapted to any particular road requirement than can be obtained in a three-speed box.

It is probable that the gear ratios in a four-speed box for military trucks will be so arranged that second speed will be used for normal starting on hard road surfaces, and that the first speed, or low gear, will have a greater reduction ratio than anything which has been built to date. This high reduction ratio low speed gear will then be in reserve for starting or running in deep sand or mud or for climbing steep grades. In effect, such a combination of gear ratios would practically result in adding to a three-speed gear box of the conventional ratios an extra low gear with an extremely high reduction ratio, to be used for starting or running in sand or mud or for climbing steep or soft grades.

Standard Control Advantages

The desirability of standardizing the control elements has been clearly indicated. When large fleets of trucks are operated by a single user, particularly if the trucks are kept in operation for more than ten or twelve hours out of twenty-four, two shifts of drivers are necessary, and there is bound to be a certain amount of shifting of drivers from one make of truck to another. Where drivers are called upon to drive different makes of trucks, they should be able to do so with facility, and much time would be saved and better average operation assured if the same motion of the driver's right or left hand or foot could produce the same result irrespective of the make of truck. Standardization of controls along these lines would not only result in more economical and efficient operation, but would also simplify the instruction of drivers.

The use of all metal wheels will undoubtedly receive careful consideration as a result of Border experience, in spite of the fact that the wood wheels with which the majority of trucks were equipped gave remarkably good service. For desert running in the northern Mexican or southwestern United States climates, any wood wheel, no matter how good, will eventually loosen in the spokes and all-metal wheels are essential for durability in such climates.

On commercial trucks of 3-ton capacity and under, steel wheels are not extensively used, due probably to the fact that for normal service wood wheels are perfectly satisfactory, and also because a set of steel wheels for a truck of 2-ton capacity or less will weigh approximately 125 lb. more than the corresponding wood wheels. For military service, however, which is bound to be extreme, any objection from the standpoint of slightly increased weight is more than offset by the necessity for durability under any climatic condition.

Standard Tread Needed

Wheel gage or tread is most important when numbers of trucks of different makes and sizes are operated over the same routes on soft roads, and trucks for American Army service ought to have a specified standard gage in order that each different size or make does not have to break down a new track in the roadway.

If all sizes of truck could be made to the present standard road gage of 56½ in., such standardization would be of the most value from a commercial as well as a military standpoint, as it would facilitate the operation of all trucks over soft country roads. Such a narrow gage is impractical for large trucks from 3-ton capacity and up, owing to constructional limitations. It would appear, therefore, that the best compromise from a military standpoint would be to ascertain how narrow it is practical to make the gage of the larger trucks and to then increase the gage of smaller trucks to a point where their tires will run within the tracks made by the wider tires of the larger vehicles.

From a commercial standpoint, this plan would slightly impair the usefulness of the smaller-sized trucks on soft roads, but if the gage finally decided upon is not so much above 56½ in. that the wheels on one side can obtain no advantage at all from one of the 56½ in. tracks on the road, the objection is not serious, while any approach to a narrower gage on present day large commercial trucks would somewhat help their performance over soft roads.

Final Drive Efficiency First Consideration

Such a standardization of wheel gage would be of immense value on trucks for military purposes, and in the writer's opinion would probably tend to increase the field of profitable operation for commercial trucks.

It is evident that the best results will be obtained from some form of fully inclosed final drive, which should be so thoroughly inclosed as to retain lubricant, and to prevent deposit of fine dust or grit on any of the working parts.

Whatever form is used, either worm, internal gear, or double reduction, it should, in addition to the foregoing requirements, be capable of efficiently and continuously transmitting the maximum low gear torque of the vehicle without overheating, and give at least 10 in. road clearance with 36-in. tires.

A highly desirable feature would be the use of some form of differential which will *automatically* prevent one wheel from spinning if it loses traction, and which will still function as a differential when the truck makes a turn.

The torque transmitting members throughout the rear axle, and through the entire driving train as well, should be able to stand up without overstressing, to withstand the sudden engaging of the clutch, with the transmission in low gear, the engine running at maximum governed speed, and the truck rear wheels locked.

The development of a braking system suitable for a military truck presents severe problems in regard to cooling. The brakes as used on our commercial trucks of to-day are not well enough cooled to stand up long under some military conditions, as for instance, handling the fully loaded truck on a three mile descent on a hard road surface with grades running up to 25 per cent and averaging 7 per cent.

Brakes as designed have sufficient power to hold the truck under such conditions, but will heat up so that the linings char slightly and wear rapidly. Water cooling is undesirable, and it is probable that some type of metal to metal brake will be necessary, which, while not so smooth in action and moister than the conventional brake faced with brake lining, will nevertheless give greater durability under continuous application.

Dust Protection Requirements

It is essential that thorough means be provided to keep dust and grit out of all working parts. Troubles from dust are more liable to result on trucks in military service than on those in commercial service, due to running in fleets, or trains, over country roads.

Along the Mexican border, during the dry season, which means for the greater part of the year, there is an extraordinary amount of very fine, powdery dust, and a train of trucks running at twelve or fourteen miles an hour will raise a dust cloud which is visible for miles. This fine dust is drawn into the cylinders through the carbureter intakes, acting as an abrasive on the pistons, piston rings, and cylinder walls, and some is apparently drawn into the crankcase through the breather, mixing with the lubricating oil and causing undue wear on all working parts of the engine. Some form of separator or air strainer for both the carbureter and breather would be highly desirable, but it should be of a simple type, not requiring too frequent cleaning, and should not be of any form requiring water.

On a military truck, the question of road clearance is of great importance. Not only should a minimum clearance of 10 in. at the center of both the front and rear axles be maintained, but the clearances under the steering knuckle levers and the steering cross tube ends must be as great as possible. Furthermore, unusually high road clearance is desirable under the chassis, midway between axles, to prevent contact with the ground when the truck is driven over a bank into a river bed or over a ridge.

Results of Frame Distortion

To take care of excessive frame distortion, which is unavoidable when operating over rough or soft roads, the radiator, engine and transmission should be carried on three-point suspensions, and with clearances sufficient to obviate any possibility of their being themselves distorted. Provision should be made to protect the steering column from any binding from the same cause, and all connections between the rear axle and frame should be arranged to permit the maximum horizontal misalignment between the two without overstressing or breaking any of the connecting members. The gasoline tank mounting should also be carefully arranged to protect the tank from twisting strains.

It is impossible, without writing an unduly long paper, to take up all the points in the design of our conventional trucks which will be more or less influenced by military use.

Many other points will be affected, such as lubricating systems, carbureter design, steering gears, springs, body design and attaching means, etc., but the points discussed above are, in the writer's opinion, those which will require the greatest changes in design to render our commercial truck suitable for military use in this country.

The War Department has made a careful analysis of motor transport, and has drawn up a specification to cover desired design of two-wheel driven trucks for service with our Army. It is improbable that any subsidy plan for military trucks, similar to the English War Department subsidy plan, will ever be put into effect in this country.

In the absence of such a plan, it is probable that the U. S. War Department specification will stand as a master specification for American truck manufacturers, in that, as they bring out new models from time to time, they will incorporate in the design such features specified in the War Department specification as will not detract from the commercial value of the truck, and, at the same time, so design the other parts that, with minimum change, modifications could be added to meet the balance of the specification. If this procedure is followed, the War Department will eventually be able to purchase at comparatively short notice, trucks which much more nearly meet its requirements than anything on the market to-day, and furthermore, many of the features found necessary from Army experience on the Mexican Border will, if incorporated in our commercial trucks, materially enlarge their operating field.

Overland Record Driveaway

MARCH 28 broke all records for Willys-Overland driveaway, 262 cars of all models being driven from Toledo by sixteen distributors and dealers in Ohio, Pennsylvania and Indiana, 100 more than the previous record.

Erie, Pa., led with the biggest individual driveaway, taking 105 cars, ranging from the light four to the Willys-Knight eight. The Kalamazoo dealer took 57 cars, while the Dayton distributor drove away 32. The balance was taken by 13 smaller cities in the midwestern States. The following day 240 more cars were driven away by another score of dealers within a radius of 250 miles of Toledo. Cars were driven to Louisville, Ky., Harrisburg, Pa., Youngstown, Ohio, and Cleveland, Ohio. Youngstown led the list on that day with 78 cars.

Further Indorse Road Suggested by The Automobile

More Letters from Highway Engineers and Other Authorities Throughout the Country Praise Proposed Through-Traffic Road and Suggest Improvements and Modifications

LETTERS continue to reach THE AUTOMOBILE from all parts of the United States expressing approval and criticizing the plan for a through-traffic motor highway suggested in the issue of April 5. Last week some of the most pertinent and interesting letters from men prominent in highway engineering circles indorsing the plan as a commonsense and practical undertaking were published in brief form. This week among the communications received are messages from officers of State automobile associations, office of the governor of New Jersey, eminent consulting engineers, State geologists, officials of roads building organizations, etc. Opinions voiced by such a representative body of men are sure to carry weight and will doubtless have considerable influence in paving the way for actual adoption and construction of roads more or less similar to the one projected by THE AUTOMOBILE. The future will require such highways imperatively, as can be seen by the veriest tyro in the study of traffic problems from the congestion we are already experiencing when our motor vehicle registration is still far below the level it will attain in a decade or two.

Among the advantages pointed out by the engineers who have examined the plan for a high-speed motor vehicle highway between New York and Philadelphia are higher speed with reduced danger of accident, greater safety for pedestrians resulting from segregation of motor traffic, elimination of grade crossings and one-way travel and more efficient operation of both cars and trucks with a proportionate increase in economy.

As previously described the road suggested by THE AUTOMOBILE would be approximately 100 ft. wide with three parallel roadways, the two on the outside being devoted to the use of automobiles and the one in the center reserved for motor trucks. Each of the automobile tracks would have capacity for three or four cars abreast and the center roadway would be sufficiently wide to admit of three trucks traveling abreast. Traffic would be in one direction only on each of the outer roadways, but the trucks in the center track would travel in both directions.

Among the letters received this week were communications from Governor Edge of New Jersey through his secretary, F. E. Croasdale; W. T. Winn, president Georgia State Automobile Assn.; Ernest P. Goodrich, consulting engineer; Joseph H. Pratt, State Geologist of North Carolina; and John C. Nicholson, president of the Meridian Road. Digests of these letters follow:

Put Slow Traffic on Outside—Goodrich

I HAVE read with much interest the article in THE AUTOMOBILE for April 5 on the appointment of General Goethals to re-organize the New Jersey highway system, in connection with which was outlined a suggested through-traffic automobile road. With your comments on the need, practicability and other construction of automobile trunk thoroughfares around towns and cities, and the elimination of other possible grade crossings, there can be no possible doubt.

I do not know how seriously you submit your scheme for arrangement of vehicles across the width of the thoroughfare. If slow moving vehicles are placed up at each turnout, whereas if the fast moving vehicles were in the center, they could shift over into the line of slow-moving vehicles at occasional points without slacking the average speed of those in the high velocity zone, finding their way across the slow speed strips along the edges to the turnout points.

I submit this as a possible improvement of your scheme. Otherwise it is desirable.—E. P. GOODRICH, *Consulting Engineer.*

Best Road Suggestion Ever Made—W. T. Winn

THE proposed automobile highway between New York and Philadelphia described and illustrated in THE AUTOMOBILE for April 5 is the best suggestion ever made relative to highway engineering in this country. Such a highway would be the greatest example of road efficiency ever constructed and would inspire other States, communities and cities to greater effort in road building.

New Jersey is exceedingly fortunate to secure the services of General Goethals as chief engineer, and I am sure that such a highway as that proposed by THE AUTOMOBILE built under his supervision would be thoroughly modern in every detail and would meet all requirements of the future as well as those of the present day.—W. T. WINN, *president Georgia State Automobile Assn.*

A Valuable Article—Governor Edge

GOVERNOR EDGE directs me to express his appreciation of the valuable article regarding the proposed automobile highway between New York and Philadelphia appearing in THE AUTOMOBILE for April 5 in conjunction with the announcement of the appointment of General Goethals as good roads builder in New Jersey. The Governor desires me to say that he is greatly pleased with the character of the article.—F. E. CROASDALE, *secretary to Governor Edge of New Jersey.*

Future Will Need Such Roads—Pratt

A THROUGH-TRAFFIC automobile road such as suggested by THE AUTOMOBILE will doubtless be required for handling the greatly increased travel by motor vehicles in the future. I believe the day is coming when in our road construction work we will give very serious thought and consideration to the question of roads for rapid automobile traffic. Suggestions regarding method of construction and location of such roads must be considered by engineers. This, of course, will come up first in connection with very heavy traveled highways between our main centers.—JOSEPH HYDE PRATT, PH.D., *State Geologist of North Carolina.*

Possibilities Are Limitless—Nicholson

POSSIBILITIES of road construction of the kind outlined in THE AUTOMOBILE for April 5 are limitless. I am very much pleased to learn that the good roads movement may have the benefit of the ability and experience of so great an engineer as General Goethals.

We are planning a great improved road out of Kansas City and south over the Meridian road to the Gulf of Mexico and Old Mexico. Several ports are located on the Meridian road, and we are urging the immediate improvement of the road to carry this increased and heavy traffic.—JOHN C. NICHOLSON, *president of the Meridian Road.*

Russia Needs Cars and Trucks

U. S. A. Makers Should Develop Garage, Repair and Service Work Now for Big After-War Business

By Donald McLeod Lay

On a mountain road in the Caucasus. This G.M.C. truck is one of a convoy being delivered to the Russian Government

RUSSIA wants an automobile industry. The field for cars and trucks is constantly growing, and the new era inaugurated by the recent revolution is sure to mean a new Russia, a country eager to adopt new business ideals, more progressive methods, and naturally along with these will come an ever-increasing need for motor vehicles. According to Nicholas A. Evalenko, member of A. M. Evalenko, Inc., general exporters to Russia, who recently returned from a trip to that country, the government will offer very attractive inducements to American manufacturers who wish to establish factories or branch assembly plants there to build cars and trucks as a part of the automobile industry in that country. There is an abundance of raw material in Russia, and labor is much cheaper than in the United States. Mr. Evalenko states that if American manufacturing methods and machinery were brought to Russia, cars could be turned out at much lower prices than they could possibly be sold for if imported.

There are at present five Russian automobile and truck manufacturers, all of whom are manufacturing for the government. All are subsidized by the government through the Central War Industrial Committee. These companies are the Russo-Baltic Car Works, which was the first automobile factory in Russia; Renault Frères, building the Russian Renault; V. A. Lebedev Aviation Co., with automobile works at Jaraslov; Moscow Automobile Works, and the Aksai Machine Co.

NICHOLAS A. EVALENKO
Member of A. M. Evalenko, Inc., general exporters to Russia, photographed on the balcony of the Palace Hotel, in Tiflis

At the opening of the war there were about 25,000 automobiles and motor trucks in use in Russia, but of course it is entirely impossible to even estimate the number there now, since practically all available motor vehicles were commandeered shortly after the beginning of hostilities, and a large percentage of those put into service at that time have long since gone to the junk heap as the result of arduous conditions and mishandling by incompetent army drivers.

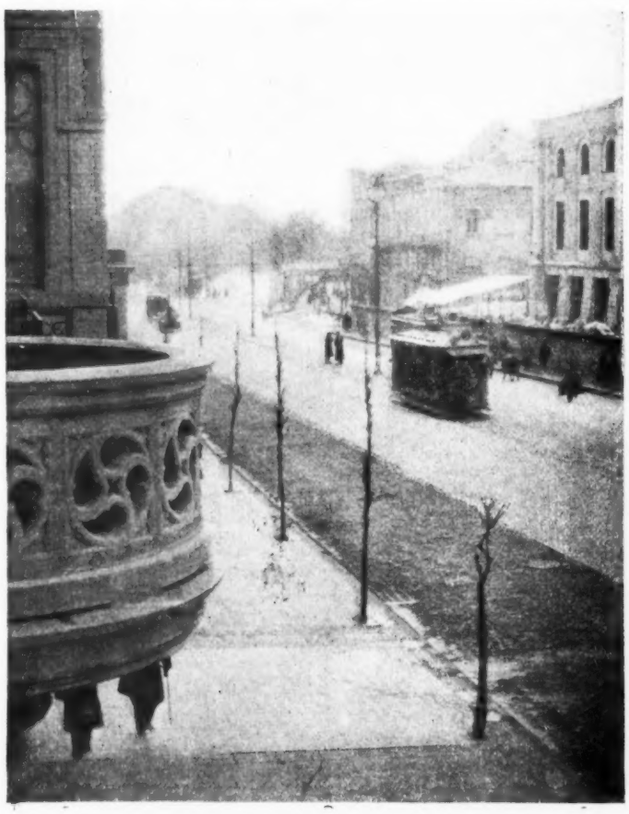
Practically all the motor vehicles shipped into Russia since the war began have been purchased by the government for its own use. Sales to individuals and private corporations have been comparatively few, as people have been fighting shy of buying cars and trucks because of fear that any vehicle purchased would be seized for military requirements almost before they had time to make any use of it. Another reason why sales of automobiles and trucks for other than government purposes have been so limited is that people are not allowed to buy United States dollars, as the government has need of all exchange. Another important factor in the situation is great difficulty of shipment owing to congestion of railroads, ships and wharves almost all the way between the factory and the Russian market. These

conditions are reflected in the prices charged for cars in Russian cities. A Cadillac seven-passenger touring car, for example, which sells for $2,240, brings approximately $6,000 in a Russian salesroom. There is no opportunity for the buyer to try out a car until he has actually purchased it. This does not trouble the Russian people who are buying cars to-day, as they consider themselves fortunate to secure an automobile under any conditions. Trucks are needed even more than passenger cars at the present time, but only the government has these vehicles, and its supply is entirely inadequate to the amount of work that has to be performed now.

Unloading cement at a roundhouse on top of a mountain in Russia. The truck negotiated the 3000-ft. climb without difficulty

It can readily be realized that the Russian army is confronted with a very serious problem in regard to its motor vehicle equipment. With practically all cars in the country requisitioned, the dealers' stocks depleted to the vanishing point, there is added the distressing situation that there are very few competent mechanics or chauffeurs, so that both cars and trucks in army service are quickly worn out, having delivered only a very small proportion of their original cost in actual performance.

There will be an unprecedented increase in the sales of automobiles and motor trucks in Russia after the close of the war. Mr. Evalenko says that this great market will become accessible for our manufacturers practically as soon as shipping conditions begin to approach normal following the declaration of peace. The Russian people used to be satisfied with horses and carriages for certain forms of business work and for pleasure driving, and in haulage work were wont to overload their horse-drawn wagons to almost the limit of the animal's endurance. To-day these forms of transportation no longer appeal to them for either business or pleasure. They want automobiles to replace their horses and carriages, and motor trucks to carry easily and with far greater speed loads that in other days made their horses pant with exhaustion to move at a snail's pace. For men of some little means the automobile presents a much more efficient and more agreeable means of transportation between their places of business and their homes than the trolley cars, which are even more crowded and slow-moving in Russia than in the most congested section of the average American city.



One of the few good streets in Tiflis. This is typical of street layout and paving in Russian cities

Our manufacturers should do their missionary work now in preparation for the great demand which will come when the war is over. Of course it is almost impossible to get cars and trucks into Russia at the present time, even for government use, as the port of Archangel is open to navigation through the Arctic waters only during the months from May to October; therefore, all shipments by the Atlantic routes must go to Kola Bay during the rest of the year, and all freight except government goods has been embargoed for some time at this port. A similar condition exists at the Pacific ports, and at all of them freight is so piled up awaiting shipment to the interior that private individuals cannot enter the market.

Market Is Not Local

It is not only in a few sections of the great Russian territory that automobiles and motor trucks are needed, but throughout the entire country. Passenger cars are wanted for both city and farm, and the same applies to motor trucks. The great forest regions of the north, which are rich in agricultural possibilities, present a big tractor market. Moreover, there are a number of great developments planned which will require large numbers of motor trucks and a supply of tractors. More intensive operation of the mines in the Ural and Caucasus regions is planned, further development of the extensive oil fields near Baku is under way, and irrigation work is to be carried on for the purpose of growing cotton in the Caucasus. It is hoped that this irrigation will result in the creation of a cotton industry on a large scale, and if this expectation is realized an increasing number of motor trucks will be needed to handle the crops. The Russians have not been slow to recognize the necessity for

trucks and tractors, not only for projects such as those mentioned but also for their regular business and farm work. The zemstvos, or chambers of commerce, in the various districts are already working for the introduction of motor trucks and tractors to meet this situation.

Three Classes Will Buy Cars

There are three classes of people in Russia who will want to buy cars when peace comes. These are the people who need cars to replace those taken by the government for war service, people who have made money out of the war, and last, but not least, the greatly increased number of people who will be able to afford a car when improved freight and market conditions, and perhaps manufacture in Russia, bring prices down to a reasonable level.

In the large cities, such as Petrograd and Moscow, it is almost imperative to keep a chauffeur, so that limousines are in the greatest demand in these centers. In the cold regions of the north a closed car is practically a necessity, but in other sections, such as the southern districts, open touring car and roadster types are satisfactory, although heavy storms make a closed car more generally useful even here. Mr. Evalenko considers that a sedan type, which may be used throughout the year, is perhaps the ultimate standard for Russian use.

Few Good Dealers

There are few good dealers in Russia, and American automobiles are known only through a comparatively small number of makes. Only half a dozen makes of U. S. A. cars are well liked, and these have met with approval mainly because they are handled by good dealers, who are able to give satisfactory service. General conditions governing the purchase and maintenance of a car in Russia differ to a marked degree from those in the United States. In America, cars are comparatively inexpensive to buy and maintain; garage, repair and service facilities are excellent, and a chauffeur is not essential to the enjoyment and practical value of a car. In Russia, car prices are far higher, a Ford costing about $1,000 before the war and approximately $1,700 to-day; garage, repair and service stations are few, scattered, and inadequate, rendering a chauffeur almost a necessity, and thereby increasing the maintenance cost, which is very high even without this added expense. Moreover, it is almost impossible to secure a competent chauffeur, especially one qualifed to do anything more than the most elementary repair work.

Make Service Stations Profitable

In working to develop a market in Russia that will stand competition our manufacturers should advocate and aid in developing garages, repair shops and service stations. These should be made business propositions, however, and not run as charity branches of the car salesroom. There is plenty of room for all such establishments that our makers can put into operation, and there should be no difficulty in turning over a handsome profit from them, at the same time furnishing the Russian car and truck owners satisfactory service at reasonable cost. At present a Russian car owner frequently has to pay as much as $25 for such a simple piece of work as adjusting a carbureter, and even then the job may not be done correctly. Repairmen have been able to impose on Russian car owners so long with their inferior work and exorbitant charges that now they really think they earn the money.

Roads Work Stopped by War

Like many other excellent things in Russia, the good-roads movement was stopped by the war just when it was beginning to get under way. There are comparatively few good roads in the country, and at present little road work is being done, except as required for war transport operations, and even this is nothing like the development on the French, British and Italian fronts. There is the military strategic road connecting Vladicofcoz and Tiflis, a distance of about 140 miles by road, as compared with some 750 by railroad; then there is the road connecting Petrograd and Moscow, which is fairly good, although some of the bridges are weak and rather dangerous; these two roads represent the best types Russia has, but in the country districts, away from the main population centers, roads are little more than trails. Roads in the Caucasus section are fair.

Ford Car Owners Organize for War

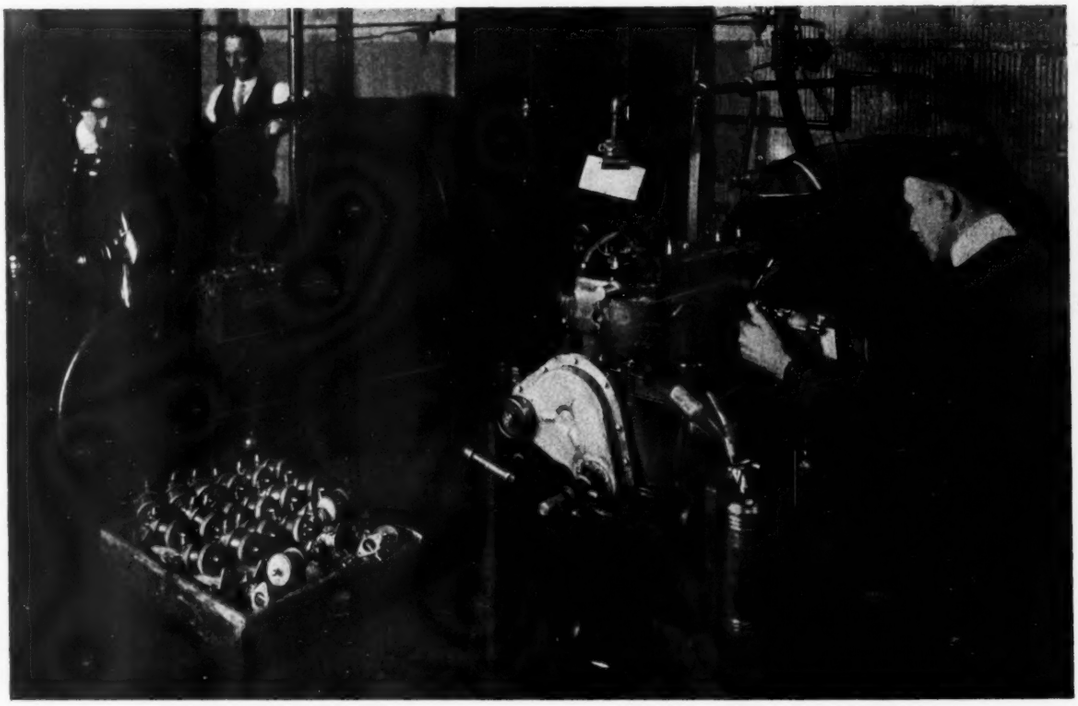
Ford car equipped with machine gun used for securing recruits for the National Ford Machine Gun Corps

HUNDREDS of Ford car owners are volunteering their services and their cars under an emergency plan worked out by the National Ford Owners' Club, 1777 Broadway, New York. These men and machines are being mobilized as the National Ford Machine Gun Corps. The plan has been presented to General Leonard Wood, Secretary of War Baker, and other army officials, all of whom have approved it and praised the idea, declaring that a corps of Ford cars equipped with rapid-fire automatic machine guns and under the supervision of army officers would prove invaluable for coast defense and similar military service. The movement is national and some idea of its scope may be gained from the expectation of President Dimond of the club, that 5000 volunteers will be mobilized from New York City alone.

Stromberg Factory Efficiency

4000 to 5000 Carbureters a Week Produced By Fewer Than 75 Men Without Overtime—Standardization a Factor

By J. Edward Schipper



Every Stromberg carbureter before being sent out is placed on an engine and operated

PROBABLY one of the most efficient factories of automobile accessories is that of the Stromberg Motor Devices Co., Chicago, Ill., manufacturers of the Stromberg carbureter. This concern has a production running between 4000 and 5000 carbureters a week, yet in the assembly department there are fewer than seventy-five men handling this entire output without overtime work. Most of this is piecework, but the efficiency of this department is representative of the conduct of the entire plant.

For instance, starting with the earlier stages of manufacture, the carbureter bodies are turned out in the foundry at an average time of 8 min. for a mold. The output is handled by eight Fischer furnaces and one Rockwell, with city gas used as fuel. The melting point of the composition used for Stromberg carbureters is about 2400 deg. Fahr., and the metal is poured at the plant at a temperature of about 3000 deg. These furnaces have a capacity of 25,000 lb. of metal per 10-hr. day.

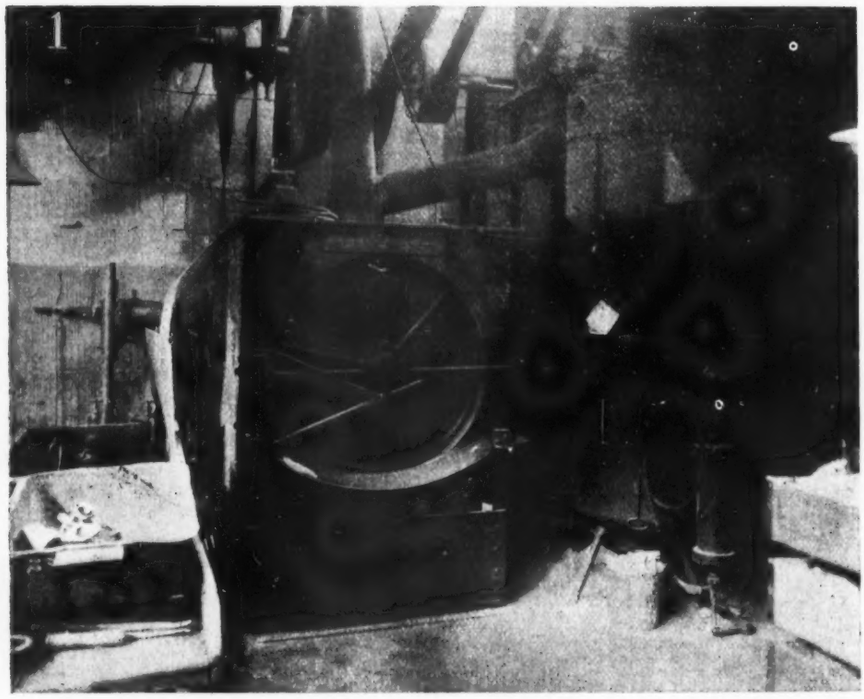
Standard Boxes, Racks and Carriers

After the castings have been made, before they are started in their manufacture they are all rough-finished in a Mott sand-blast barrel. This is a tumbling barrel with sand jets. It gives the castings a preliminary finish which enables them to be handled in a much cleaner state than that of the raw casting. From the time the carbureters are cast and rough-finished up to the time they are assembled they are carried along in standard boxes placed in standard racks and transported by standard carriers. The racks are made up of pipe fittings, as shown in 2, page 786.

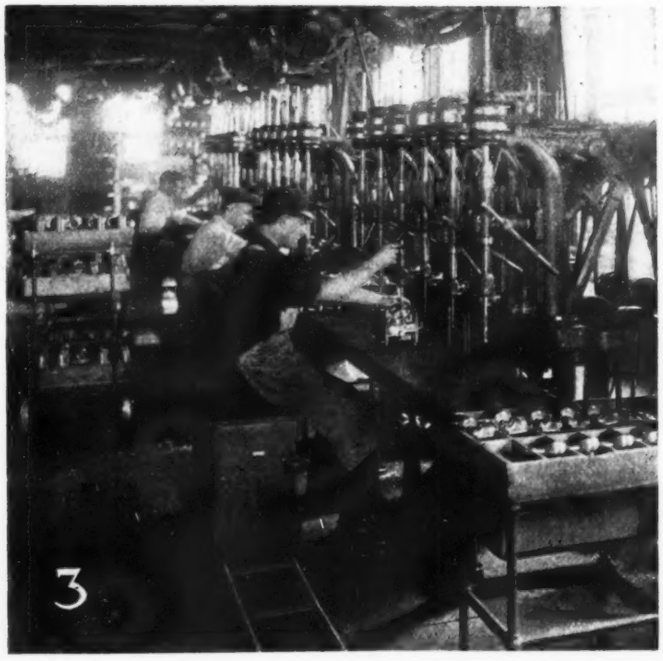
Efficient Machine Layout

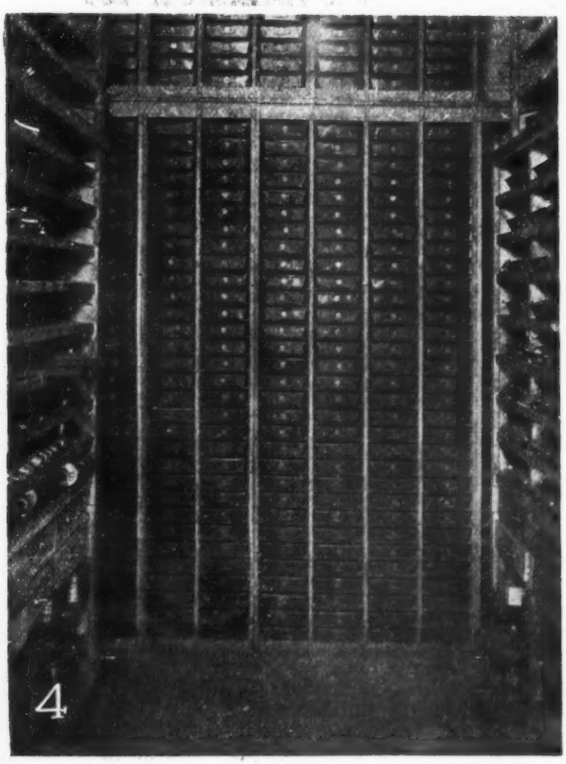
Most of the manufacturing steps after the casting has been taken out are machine jobs, including milling, drilling, tapping and similar operations. It is in the layout of the machines and in the motion study of the operators that the high efficiency is obtained. For instance, referring to 3, page 786, where progressive drilling is taking place, the operators sit at drill presses on seats which slide along metal tracks. These tracks are not fastened to the floor, but can be placed at any distance from the table so that the operator can shift the track until he is in his handiest position. Each of these operators has his own separate toolbox and rack with an independent key to the box. One of these toolboxes, together with the standard racks and carbureter bodies, is shown in 3, page 786. Practically all of these drill presses are run at speeds from 5000 to 10,000 r.p.m., and in the drill department there is a total of 170 spindles.

Naturally, the automatic department keeps in step with the hand and semi-automatic machinery, so that the production schedule is carried out continuously. One of the machines in the screw-machine department



Steps in Manufacturing Stromberg Carbureters



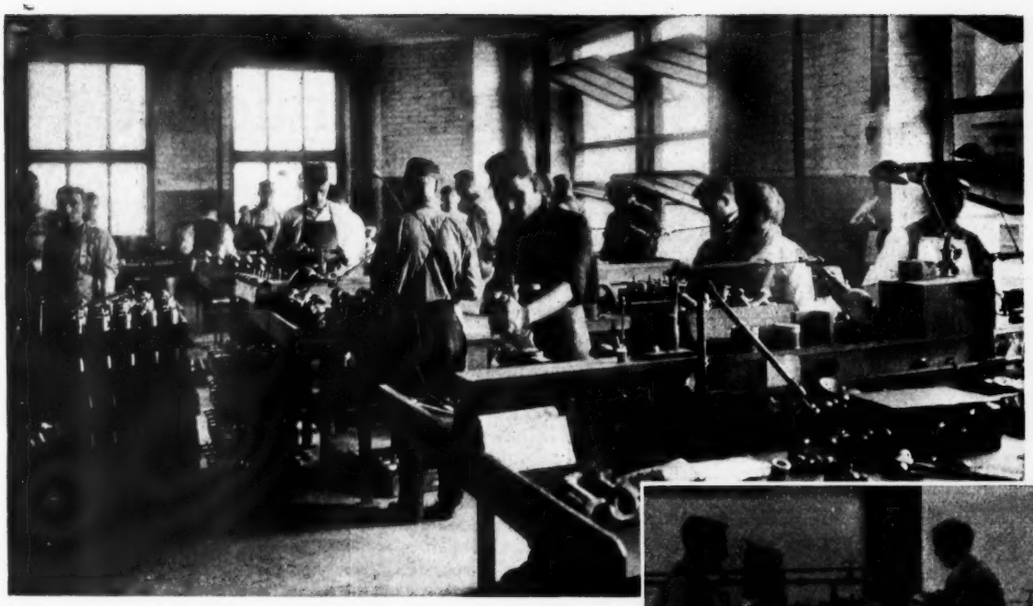


1—Castings all rough finished in a Mott sand blast barrel. This is a tumbling barrel with sand jets

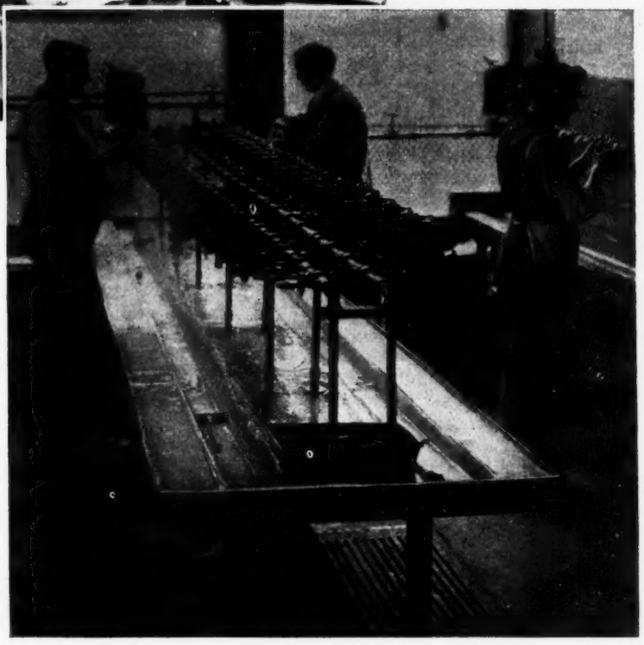
2—All the parts leading up to assembly are carried in standard size boxes and these boxes are placed on standard size racks and transported by standard carriers

3—Stromberg operators at drill presses sit on seats which slide along metal tracks. The latter are not fastened to the floor, but can be placed in any position so that the seat is the desired distance away from the machine

4—In the Stromberg tool storeroom are pans which carry the tools required to make any part of any model of carbureter built by the company



Left—All Stromberg carbureters are hand filed before the finish sand blasting



Below—All Stromberg carbureters are mounted on stands to test for float level which is set at the proper point for the type of fuel feed to be used

turns out ten finished screws a minute. The ingenious part of this machine is that it not only cuts the screws and threads them, but also slots them by means of a carry-over hand which takes the screw from the main chuck over to a little slotting cutter on the side.

Tool Storeroom Is Complete

An interesting department is the tool storeroom. Here in hundreds of pans are kept a complete set of tools for each job. All these pans are the same size and each pan contains a set of tools required to make any part of any model. This represents a tremendous investment in pans and tools, but with it any part can be reproduced at any time in the future by simply slipping the pans and tools into the automatics or other machines, as the job requires. This storeroom is illustrated in 4, page 786.

Before the carbureters go to the finish sand blast room they are all hand filed. This gives the Stromberg carbureter its characteristic smooth outside appearance. The operation of hand filing is illustrated above. When this is completed the carbureters are then turned into the finish sand blast room, after which they pass on to final assembly. During all this work an inspection is carried on after every operation, regardless of how small.

Testing for Float Level

One of the most interesting tests is the method used for testing for float level. All the carbureters are mounted on stands and the float level set at the proper point for the type of fuel feed to be used. A vacuum feed requires a different float setting than one which is fed by pressure, the variation being caused by the difference in hydraulic head of the gasoline. Above, at the right, is shown the test for level.

Finally, before the carbureter is sent out, it is mounted on one of the engines shown on page 785, where it is operated under actual running conditions before being finally passed for the finished stockroom, where there are always from 10,000 to 20,000 carbureters in stock, and in the unfinished stockroom there are always from 15,000 to 20,000 raw bodies ready for assembly.

The Stromberg factory is one of those which have been offered to the United States Government in the present crisis. The value of such an organization and its facilities for war work requires no comment.

Conservatism Prevails in 1917 Business

BUSINESS is traveling at a conservative pace. The volume of trade in the early part of 1917 shows a slight decrease from that of the closing months of 1916. This is a welcome sign, in the opinion of the digest prepared by the First and Security National Bank of Minneapolis. Many industries have orders booked so far in advance that any further stimulation of trade at the present time would not be desirable.

The number of business failures in on the decrease. There were 350 less concerns went to the wall this January than last. The liabilities in the failures for the current year were $5,000,000 less than for the same period in 1916. Financing by corporations totaled $10,000,000 less at the beginning of this year than at the start of 1916. This does not include loans to foreign governments marketed in the United States. The capitalization of corporations formed in January, 1917 is $312,000,000 as against $335,000,000 for the first month of the year before.

The earnings, however, stated in the terms of dollars are larger, although the decreasing purchasing power of the dollar may be one cause of the apparent dollar growth in profits. February dividends equaled $155,000,000 as compared with $128,000,000 of February, 1916. Building operations, coal shipments, oil well yields, and the domestic consumption of cotton are showing marked gains over the early part of 1916.

Business Papers Pledge Influence

Editorial Conference of New York Class Journals Unanimously Adopts Resolution Meeting President's Appeal—Talks on Present Problems

RESOLVED: *The members of the Editorial Conference of the Class Journals of New York City, here assembled, are glad to respond to President Woodrow Wilson's appeal in his proclamation of April 15 and will do all in their power to lead and inspire the industries they represent to render that patriotic service to the nation which the President has requested.*

THE accompanying resolution, pledging the influence of the Editorial Conference of the New York Business Publishers' Assn. to meet the appeal in President Wilson's proclamation of April 15, was unanimously adopted at a meeting of the conference April 16. Following the wiring of the resolution to Washington a number of the largest problems which the country is facing since its entry into the war were analyzed by editors whose publications are studying these problems and seeking their solution. These men are experts in their respective fields and represent the most wide awake elements of these industries. A summary of the points covered in their brief talks follows:

Lack of competent drivers and of suitable roads are the two great handicaps in utilizing the 250,000 motor trucks in the United States to-day, according to Joseph Husson, editor *The Commercial Vehicle*. Mr. Husson advocates the advisability of profiting by the lessons already learned by France and Great Britain in the use of motor trucks in war.

The importance of machine shops and factories for munitions work and the present preparedness of our factories, due to the industrial census conducted by the Council of National Defense, were subjects concisely outlined by J. H. VanDeventer, editor *The American Machinist*.

American steel and metal-working plants will be occupied to full capacity until the end of the war, according to A. I. Findley, editor *The Iron Age*. Increased consumption of steel for munitions work, ship building and railroad development is bound to continue. Mr. Findley predicts that automobile factories will receive millions of dollars' worth of orders, including large numbers of armored trucks. Another factor, he points out, will be the great growth in foreign trade consequent on our entry into the war.

Floyd W. Parsons, editor of *Coal Age*, warned of the serious effects of a national coal shortage due to inadequate transportation facilities, greatly increased consumption and reduced labor supply consequent upon throwing our resources into war work. Mr. Parsons cited six ways in which factories and individuals can serve their country and themselves at the same time by working to prevent a coal famine.

Even if the 15 per cent increase in freight rates becomes effective June 1, revenue from this source will be but a drop in the bucket compared with an increase of over $500,000,000 in the 1917 operating expenses of our railroads, according to R. V. Wright, editor of *Railway Age Gazette*. Mr. Wright emphasized the fact that, instead of 15 per cent more revenue this year, the roads will get only 7/12 of 15 per cent and voiced a plea for repeal of the full crew law, citing its unnecessary added expense of $60,000,000 a year. Wages are $40,000,000 higher this year than last; fuel costs $100,000,000 more; taxes add $22,000,000; locomotives, cars and rails $225,000,000 more and so on.

Preparedness of the electrical industry was described by F. M. Feiker, editor *Electrical World*, who told of the activities of three groups, the engineers, central station industry and the electrical manufacturers, all of whom are ready and competent to take important parts in the national war program. Mr. Feiker told of lighting work which would serve to protect factories and public buildings, thus freeing men otherwise needed as guards for other work; of developing electrical heating, thus conserving the nation's fuel; and of speeding up plant outputs by scientific lighting.

Other short talks were delivered by Dr. E. F. Roeber, editor of *Metallurgical and Chemical Engineering*, on the Nitrate Problem; V. E. Carroll, editor *Textile World Journal*, on the Textile Industry in War; and H. L. Aldrich, *International and Marine Engineer*, on building standardized wooden ships to overcome the submarine blockade system.

Digests of the talks most closely related to the automobile industry follow:

Motor Truck Industry Prepared for War Work

By Joseph Husson

Editor The Commercial Vehicle

WAR finds us prepared in motor trucks, unprepared in personnel to operate them and sadly unprepared in roads over which they can be run. There are approximately 250,000 motor trucks of all classes and sizes in use in the United States to-day in all lines and all classes of business. The total present output of motor trucks of all kinds is close to 700 per day, although not all of these are suitable for war service. Six of our truck makers can supply 100 trucks suitable for army needs a day, under present manufacturing conditions, and this output can be almost doubled by them should the necessity arise. Our government already has something over 2000 trucks which it purchased for use with the Mexican expeditionary force. These are all available and most are ready for active service on the moment. Yet only 11.3 per cent of our 2,451,660 miles of roads are surfaced and can possibly be used for truck work every month of the year.

Taking a leaf out of a lesson book of the European nations, it is not the intention of our government to commandeer indiscriminately the trucks of private users, especially those engaged in industrial work, which the experiences of the war abroad have proved of as vital moment to successfully carrying on a campaign as it is to have the army supplied with everything it needs for actual work in the field.

We are still novices in preparedness work as compared with the nations abroad and we must take the advice of the special commissions which France and Great Britain are sending to our shores. We are the richest nation in the world, with the greatest resources, and yet we are not quite certain how we shall use these to the best advantage. To avoid the mistakes made abroad we must make haste slowly and avail ourselves of the experience of Great Britain, whose position was most nearly like that of our own at the outbreak of the war.

One of these lessons which the War Department has already learned is indicated by its intention not to confiscate civilian motor trucks for war work, but to purchase trucks from the makers and in this manner avoid paralyzing

our industrial transportation. Our truck makers stand ready to meet this demand, whatever it may be. Civilian trucks will not be used according to present plans except in cases of necessity in districts local to those in which they are ordinarily engaged.

One of our greatest problems in connection with the motor transportation needs of the army is to obtain competent motor truck drivers. To secure such men from among the ranks of the present-day drivers will tend to paralyze the efficiency of our industrial truck work, which is just the thing which should not be done.

Training Camps for Drivers

To secure competent drivers from among the ranks of the passenger car owners and chauffeurs and to train novices would seem the most likely method, yet even this would require a considerable amount of training. It would be necessary to establish training camps in various parts of the country in which truck driver applicants might be trained first hand in driving trucks over all sorts of roads. The training necessary for a motor truck driver in army service requires considerably more knowledge and experience than that possessed by the average passenger car driver, as shown by the results of our Mexican expeditionary force. These men must be trained to keep their vehicles in convoy formation, to extricate their trucks from mires in bad roads, to perhaps run at night without lights over unknown stretches of roads and perhaps to keep their seats in the cab for 24 hr. at a time.

In suitable roads for military service we are sadly lacking, especially throughout the great Mississippi Valley, which is the greatest grain producing area in the Western Hemisphere. This huge territory is practically barren of usable roads on which trucks could operate 12 months of the year. Should this great agricultural valley be attacked from the south across the Mexican frontier, motor trucks would be positive necessities.

Due to the fact that the railroads do not run up to the guns, it would be imperative to handle the ammunition by motor transportation. The gigantic size of this problem can be realized when on the French front it requires a fleet of 480 trucks to handle enough ammunition to feed the big guns for 2½ hr. In Italy, twenty-four motor trucks are needed continuously to supply ammunition for one large gun. From this it may be seen that practically preparedness means permanent roads, and that while our makers can furnish a sufficient number of trucks and while drivers may be trained to drive them, they will be practically useless unless we have permanent every-day-in-the-year roads over which they can be run.

Steel and Metal-Working Industries Not Radically Affected

By A. I. Findley

Editor The Iron Age

THE steel and metal-working industries of the United States have so long worked under the stimulus of war demand that the addition of this country to the list of belligerents has caused no radical readjustments. Instantly the producers of steel prepared to put government requisitions ahead of all other work. But this will mean no dislocation of the industries; merely the passing of a small percentage of the finished-steel output through new channels. Where the government, for example, takes over vessels in process of construction there will now be deliveries of plates and shapes on government account, and in some cases more rapidly than would have been the case. Navy yard and shipyard additions, also, will come in for early rollings of steel, chiefly plates and structural shapes. Thus far the government has indicated that 500,000 to 600,000 tons of plates and shapes and bars will be called for this year, largely in connection with its naval program and the private shipyard work which will be pushed ahead to take care of government needs. That means only about 2 per cent of the country's present finished-steel production.

The canning trade will call for many thousands of tons of tin plate beyond its normal needs. Automobile works will receive millions of dollars worth of orders, including, no doubt, large numbers of armored trucks. Shipbuilding, apart from government requirements, will see a great expansion. Railroads will increase their car and locomotive and rail orders because of the new strain put upon their facilities. The country-wide movement for an increase in crops of every character will make its demand upon iron and steel works.

Beyond all these immediate effects is the now incalculable but very important factor of the trade during and after the war which will come to the United States from all parts of the world, because it is one of the Entente Allies and is to extend large credits to the countries fighting with it.

Outstanding facts about the American steel trade and the situation as it now appears are that the full capacity of this country will be occupied at least until the war ends; that to-day's high prices will continue and are likely to be exceeded; that wages will still tend upward, with labor increasingly scarce; that food prices will continue high.

U. S. Factories Organized

By J. H. Van Deventer

Editor American Machinist

IT is perhaps easier to surmise what will happen to the machinery-building and machine-shop industry now that we are at war, since we have had opportunity to see what happened to these industries during the last 2½ years. And since modern battles are largely decided by machine shops, it is a good thing that our country can start with a 2½-year education handicap instead of from scratch.

An editorial published in the *American Machinist*, in June, 1915, pointed out the importance of the machine shop simply in the matter of artillery ammunition manufacture and consumption. What we said then in the following words, can be equally well said now:

"If anyone doubts the vital importance of the machine shop in modern warfare, a little consideration of recent events will make it perfectly clear. Reports of the rapid firing of the French 75's in a recent battle give some idea of this.

"Approximately 250,000 shells were fired in this engagement, some of the guns firing twenty a minute. These shells weigh 18 lb. each, exclusive of the powder case, so that 2250 tons of metal were shot through the air.

"But the most striking feature is the time taken to make these shells, which represent at least 5 hr. of labor each; 250,000 shells will then take 1,250,000 hr., or 416 years for one man working a 10-hr. day. A good-sized shop employing 250 men will require 20 months to make this number of shells to be blown away in a single day's action."

Since that time the number of hours of labor on a shell of this kind have been considerably reduced, but to make up for this the use of artillery in blasting a path for the advance of infantry has been enormously increased, so that simply in the matter of artillery ammunition it will be seen that if our guns get into action it will take a great many machine shops to keep them loaded.

It is interesting to note by contrast the much more favorable position we are in in this respect to-day than 2 years ago. I had a first-hand opportunity to study conditions in Canada when they started to make ammunition in shops that had but a vague idea of which end of the gun the shell went in and which end it came out. The troubles that these people had in getting started caused some anxiety as to what would happen to us under like circumstances, with the result that we published an editorial in April, 1915, from which I will quote:

Machine Shops an Asset in National Defense

"The experience of Canada illustrates the importance of the machine shop as an asset in national defense. The government forced to depend in time of war upon the output of its own arsenals would soon experience a shortage. There is a lesson in this which would be carried home forcibly to us of the United States. In the event of a war in which we were involved, one of the first and most insistent demands would be for ammunition. The arsenals of the government would be

inadequate to supply one-tenth of what would be required. As the dominion government was forced to go to its private manufacturers so our government would be compelled to go to the machine shops of the United States. It would find most of them in absolute ignorance of what shrapnel and explosive shells were like, to say nothing of how to make them. Much time would be consumed in securing proper gages and in getting the suitable equipment for the various machines to enable them to handle the work. Meanwhile, time of the greatest value would be irredeemably lost.

Classification of Machine Shops Essential

"Now let us look at the other side of the picture. Take a government, for example, in which all of the machine shops capable of turning out work of this kind have been suitably classified and recorded in the War Department offices. It is known just how many shells of a certain size can be expected from the Jones Mfg. Co. within a week after demand, and how many can be obtained from Smith's machine shop. In addition to this both Jones and Smith know what size shell they will be expected to make, and where the raw material is to come from. They know how to go about this, for they have a complete set of gages in their plant. In addition to this, they are familiar with the whole process of making the piece in question, for instead of depending upon its arsenals for the supply of ammunition annually required in peace time this mythical government that we are describing has placed a large part of this class of work with private concerns with the purpose of preparing them for just such an emergency."

Bear in mind that these words were written 2 years ago and that since that time what we ascribe to a mythical government as an ideal has substantially been carried out by the United States. Information has been spread broadcast regarding the manufacture of munitions, largely through the columns of the technical press. The Council of National Defense, with its various subcommittees, has been organized and through it a census of the machine shops and other manufacturing plants of America has been completed. Master gages for shells have been completed and contracts let and under way for working gages for the private plants who undertake to make shells on government contract. In addition to this, we have the almost inestimable asset of 2 years of skill acquired in making ammunition for the allies, in finding the obstacles and in learning how to circumvent them.

But in spite of this start American machine shops will be taxed to the limit to supply the demands for an army of the size proposed. We are going to feel the shortage of skilled labor more than we have felt it during the last 2½ years; organizing and managerial ability will be taxed to its utmost. But, despite these difficulties, American machine shops will do their part, for employers and employees are, as never before, united in one purpose—the upholding of national honor.

Coal—A Great Problem

By Floyd W. Parsons

Editor Coal Age

PRESIDENT WILSON, in his national appeal this morning, says that the railroads are the arteries of the nation's life. I may add that fuel is the heart of the nation's life. Without coal, coke and oil there can be no circulation. Without adequate transportation lines, there will be paralysis and death of vital parts.

The United States holds 51 per cent of the coal reserve of the world. Germany, in her own boundaries, holds 6 per cent Our coal production is 600,000,000 tons actually, or nearly 50 per cent of the world's total output. Nearly 1,000,000 men are employed in our coal mines.

The problem we now face is the production of more coal and coke with fewer men. Even though the government may exempt coal miners from military service, there will be many who will go in one capacity or another. In Great Britain 250,000 miners are at the front. We may expect fewer men in our mines soon.

Petroleum and water are supplementary sources of power. The yield of the former is not likely to be increased; development of water power is slow. We must, therefore, have more coal to meet larger transportation requirements for handling food, munitions and to supply new ships.

Naval fuel requirements in times of peace are limited; under stress of war they are enormously increased.

Great Britain is short 15,000,000 tons of coal. Fuel is even more scarce in continental countries. They will expect help from us this next winter. How can we reach the situation? Here are a few ways:

1—Increased efficiency from a centralized control, or fuel board, such a commission to be made up of competent representative mining men. This particularly would elliminate absenteeism in mines. Great Britain absenteeism in the mines is 9 9/10 per cent, of which 5 per cent comes from indifference to the country's welfare.

2—Co-operation of mines and railroads so as to cut corners, lessen the unnecessary movement of cars and prevent congestion in certain localities. This will require a redistricting of the country so that railroad hauls will be shortened. Coal must be shipped to market from the nearest mines, and not from one State 500 miles across three other States that have an unlimited supply.

3—It will be the patriotic duty of manufacturers and of all citizens to accept, if need be, grades of coal they have not been accustomed to use. This means an immediate extension of education work.

4—It may be necessary to concentrate mine labor and shipping facilities at certain points.

5—Coal operators and miners must not take advantage of national stress by raising taxes unduly.

6—Everyone should be urged to buy all the coal they can afford during the next 6 or 8 weeks. Prepare this summer and the miners will do their part next winter.

Textile Industry Deplores Confusion

By V. E. Carroll

Editor Textile World Journal

NATURALLY, the textile industry is most intimately concerned with the clothing of the country's soldiers and sailors, and the efforts of this industry are bent toward the best solution of the many problems which confront the government through its various officials and departments.

It has been evident since the declaration of war that the innumerable details which confronted the Council of National Defense and the herculean tasks which devolved upon the department officials have resulted in more or less confusion and uncertainty of effort. It has been with difficulty that committees appointed by certain divisions of the trade obtained recognition from the Council of Defense and after such recognition the difficulty was equally great to secure conferences and to obtain official expressions of opinion. Even at the present time those who have been intimately associated with the advisory bodies declare there is no definite or systematic plan in evidence.

Commandeering of Mills

The commandeering of mills or their products was prominently discussed as soon as war was declared, but with the pronounced willingness of manufacturers to place at the disposal of the government any or all of their machinery, the likelihood of such action seems to be growing less and less. Whether the Quartermaster's Department will decide upon a fixed price over and above cost at which supplies will be purchased, remains to be seen. Reports have been current that a profit margin of 7½ to 10 per cent would be allowed, but the difficulties of establishing such a basis are immeasurably increased by the decision not to accept raw material and apportion it to manufacturers. That large orders have been placed in the open market in addition to regular contracts, awarded as the result of former bids, is generally known, but unusual secrecy is observed with regard to this business and those to whom orders have been given have been cautioned for obvious reasons not to make them public.

The textile industry, while yielding nothing to other industrial factors in the matter of patriotism, realizes the necessity of caution in the matter of enlistment from the ranks of its employees. With a knowledge of the blunders and disastrous results following indescriminate enlistment in England leaders in the trade are making clear the desirability and even necessity of conserving the production of their plants and are advising those whose work is absolutely necessary to a continuance of operations that they will be performing as patriotic a duty by continuing in their managerial capacity as though they enlisted for active service.

Automobile Calendar

CONTESTS

1917

May 10—Uniontown, Pa., Speedway Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Cincinnati, Ohio, 250-Mile Race.
May 30—Uniontown, Pa., Local Races.
June 9—Chicago, Ill., Speedway Race.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 4—Uniontown, Pa., Speedway Race.
July 4—Tacoma, Wash., Speedway Race.
July 4—Visalia, Cal., Road Race
July 4—Spokane, Wash., Track Race.
July 4—Benton Harbor, Mich., Track Race.
July 14—Rochester, N. Y., Hillclimb.
July 15—Missoula, Mont., Track Race.
July 17-19—Buffalo, N. Y., Intercity Reliability.
July 22—Anaconda, Mont., Track Race.
July 29 — Great Falls, Mont., Track Race.
Aug. 5—Billings, Mont., Track Race.
Aug. 17—Flemington, N. J., Track Race.
Sept. 3—Uniontown, Pa., Speedway Race.
Sept. 3—Cincinnati, O., Speedway Race, Championship.
Sept. 6—Red Bank, N. J., Track Race.
Sept. 8—Hillclimb, Pike's Peak, for stripped stock chassis.
Sept. 15—Providence, R. I., Speedway Race, Championship.
Sept. 22—Allentown, Pa., Track Race.
Sept. 28—Trenton, N. J., Track Race.
Sept. 29—New York Speedway Race, Championship.
Oct. 6—Danbury, Conn., Track Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 13—Richmond, Va., Track Race.
Oct. 13—Chicago Speedway Race, Championship.
Oct. 27 — New York Speedway Race.

SHOWS

April—Milwaukee, Wis., Spring Show, Milwaukee Automobile Dealers.
April 20-26 — Milwaukee, Wis., Used Car Show, Milwaukee Automobile Dealers, Auditorium.
April 23-28 — Superior, Wis., First Annual Superior Show, Truax Block. W. T. Daley, manager.
Sept. 2-9—Spokane, Wash., Interstate Fair.
Sept. 9-15 — Milwaukee Show, State Park Fair, West Allis.
Sept. 9-15 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, West Allis, Milwaukee Automobile Dealers.

S. A. E. Calendar

Standards Division Meetings

APRIL

20—Aeronautic, New York.
23—Tire & Rim, Cleveland.
26—Springs, New York.

MAY

1—Iron and Steel, Cleveland.
2—Lighting, Cleveland.
2—Research, Cleveland.
2—Transmission, Detroit.
3—Standards Committee, Cleveland.
6-7—Research, Indianapolis.
9—Tractor, Chicago.
16—Ball and Roller Bearing, New York.
18—Truck Standards, New York.
22—Lighting, Cleveland.
25—Aeronautic, New York.
25—Miscellaneous, Detroit.
29—Research, New York.

JUNE

5—Starting Battery, Detroit.
7—Engine, Detroit.
8—Transmission, Detroit.
14—Electric Vehicle, New York.
18—Standards Committee.

Section Meetings

APRIL

20—Cleveland—Hollenden Hotel. Automobile Engine Cooling, A. K. Schanze of Pitter Fan Co.
26—Pennsylvania, Problems Involved in Ignition Development, W. A. Evans, Research Engineer, Atwater Kent Mfg. Works.
30—Detroit — Annual Business meeting.

MAY

17—Metropolitan, Engines that Will Burn the Fuels We Shall Have to Use. Papers by H. G. Chatain on the Diesel and P. O. Scott on the Junker.

Engineering Calendar

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automobile Engineers.
Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials.
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architects and Marine Engineers.

APRIL

20—Illum. Eng. Soc., Edison Bldg., Chicago, 6.45 p.m. Office Lighting by S. G. Hibben.
21—Assn. Iron and Steel Elec. Engrs., Fort Pitt Hotel, Pittsburgh. Directors' meeting, 3 p.m., Dinner, 6.30 p.m., Papers and Discussions, 8 p.m. Short papers by members of Standardization Committee.

MAY

5—Assn. Iron & Steel Elec. Engrs., Majestic Hotel, Philadelphia. Some Recent Applications of Electricity in the Steel Industry by G. E. Stoltz.
8—Soc. for Elec. Development annual meeting.
12 — Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
17—Mining & Met. Soc. of Amer. monthly meeting New York section at Engrs. Club.
18—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
19—Assn. Iron & Steel Elec. Engrs., Fort Pitt Hotel, Pittsburgh. Auspices of Power Committee, W. O. Oschmann, chairman. Power Cost Accounting Systems as Practised by Several Steel Mills in Pittsburgh District.
21—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21-24—Amer. Soc. Mech. Engrs. Spring meeting in Cincinnati. Joint session May 22 with Nat. Mach. Tool Bldrs. Assn.
29-June 1 — Nat. Elec. Light Assn. Convention at Atlantic City.

JUNE

2—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
5-7—Nat. Gas Engine Assn. annual meeting at Chicago (Sherman House).
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
9—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13-14-15 — Amer. Ry. Master Mech. Assn. convention, Greek Temple, Atlantic City, N. J. Hdqrs. Marlborough-Blenheim Hotel.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
15—Illum. Eng. Soc. Pittsburgh section, Office Building, Lighting and Inspection Trip through City and County Building. Mr. S. G. Hibben.
16—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
18-19-20 — Master Car Bldrs. Assn. convention, Greek Temple, Atlantic City, N. J. Hdqts. Marlborough-Blenheim Hotel.
20-22—Amer. Inst. Chem. Engrs., Ninth Semi-Annual Meeting at Buffalo.
21—Mining & Met. Soc. of Amer. New York section monthly meeting at Engrs. Club.
26-30—Amer. Soc. for Test Mat. annual meeting Atlantic City.

JULY

7—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
14—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
16—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

AUGUST

4—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
11—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
20—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

SEPTEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10-14—Assn. Iron & Steel Elec. Engrs. annual convention at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
11—Amer. Soc. Heat & Vent. Engrs. monthly meeting Mass. section at Boston.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat & Vent. Engrs. monthly meeting Ohio section at Cleveland.

Standard Specifications

For

1½-Ton and 3-Ton Gasoline Motor Trucks

April—1917

Prepared by Motor Transport Board of War Department, in Accordance With Recommendations of the Truck Standards Division, the Springs Division, and the Electrical Equipment Division of the Society of Automotive Engineers

Approved by the Quartermaster General

¶ NOTE: The following specifications apply to 1½-ton trucks only. The modifications in specification requirements for the furnishing of 3-ton trucks will be given in an appendix hereto.

GENERAL CONDITIONS

1. The number of trucks required will be stated in the "Instructions to Bidders," issued by the Purchasing Quartermaster, and the prices quoted will be f.o.b. factory. Each truck must be complete in every respect, and in proper operating condition.

2. QUALITY OF MATERIALS: Except it be otherwise specified, all materials are to be the best of their respective kinds, and all labor is to be done in a thorough and workmanlike manner. In all cases where an article is mentioned in these specifications in connection with the words "best quality," "best made," "proper," or "suitable," the Purchasing Quartermaster or his authorized representative shall decide what is the best and most suitable to use.

3. AWARD OF CONTRACT: The trucks herein specified are to be used in the field service of the Army, and in the selection of trucks and award of contract, the quality of material, design, workmanship, and suitability for use in the Military field service will be given due weight in determining which proposal shall be accepted.

4. MANUFACTURERS: Each bidder must submit a complete list of manufacturers and location of factories furnishing any part, either finished or unfinished, assembly, or accessory, which is used in the construction of the trucks, and not made in the factory where the trucks are constructed. This shall not be construed as including bar or sheet stock or structural material. If this information is not given the proposal may be rejected, or in case the proposal is accepted, the Quartermaster Corps reserves the right to name the manufacturer and select the material, apparatus, parts, or accessories, and no others will be substituted for those named.

5. EMPLOYMENT OF CONVICT LABOR: In the performance of work herein specified the contractor shall not, directly or indirectly, employ any person undergoing sentence of imprisonment at hard labor, which may have been imposed by a Court of any State, Territory, or Municipality having jurisdiction, nor permit such employment by any person furnishing labor or material to said contractor in fulfillment of this agreement.

6. PATENTS: The contractor shall for all time secure to the Government the free and undisputed right to use any and all patented articles used in the work, and shall defend at his own expense any and all suits for infringement of any patent or patents, and in case of adverse claims under patents, the contractor shall pay all awards.

7. DESIGN: The truck must be of well balanced design, and the material and workmanship of the highest standard employed in commercial practice. It must be constructed in the most substantial manner, and all parts of truck so designed and constructed as to be readily accessible for adjustment or repair.

8. STRENGTH OF PARTS: All parts of truck, from motor to and including driving wheels, must be of such size, material, design, and strength, as to readily transmit the full power of the motor at the different gear ratios, with a proper factor of safety, with a minimum wear on parts, and with maximum mechanical efficiency. The frame, springs, and all parts of truck chassis, must have sufficient strength to carry the maximum gross loads in the most severe service conditions, with a proper factor of safety.

9. INTERCHANGEABILITY OF PARTS: All parts of truck must be constructed to definite standard dimensions, with proper tolerance and clearances, so that any part of same may be replaced and properly fitted and adjusted without requiring additional tool work or machine work on the parts.

10. STANDARD PARTS: It is desired that as many parts of the truck as practicable be of standard design and constructed to standard dimensions, which will make them interchangeable with the same parts made by other manufacturers. It is also desired that these parts be so constructed in accordance with S. A. E. standards.

11. MATERIALS: A complete list of all materials used in the construction of the various parts of the truck must be given, together with the chemical composition and physical properties of same.

12. HEAT TREATMENT: All steel used in the construction of the truck must be properly heat treated, if such treatment is necessary to develop the best physical properties for the particular purpose for which the material is being used.

13. A complete description of the methods of heat treatment for various purposes and materials must be given, together with a description of the equipment for same.

14. All information in reference to the heat treatment will be considered confidential if so requested by the bidder.

15. DRAWINGS AND DATA: Each bidder will be required to submit complete dimensioned detail and assembly drawings, showing the size and construction of every part of the truck. These drawings must show the shop limits on all parts and a reference number or letter referred to the list of materials, physical properties, and heat treatment, which list will also be submitted with the proposal. The drawings must be arranged in proper order for filing, and provided with a suitable index which will enable any individual drawing to be readily located. The drawings and data above referred to will not be opened publicly with the proposal, but will be considered confidential. The drawings and data may be submitted direct to the Quartermaster General, Washington, D. C., and should be referred to in each proposal which is submitted.

16. If the drawings and data herein re-

quired are on file in the Office of the Quartermaster General, they need not again be submitted with the proposal. If any major changes have been made in the construction of the truck, materials used, or methods of heat treatment, since the drawings and data were submitted, details of those changes must be submitted with the proposal.

17. SERVICE STATIONS: Complete information regarding the location of all service stations, the floor area of each station, and the number of men employed in each service station, should be submitted with the proposal.

18. DEPARTURE FROM SPECIFICATION REQUIREMENTS: In case the vehicle on which proposal is submitted does not comply with these specifications in every particular, the bidder must state definitely in what particulars the vehicle which he proposes to furnish does not comply with the specification requirements.

19. Attention is invited to the fact that in the purchase of trucks, preference will be given to those vehicles which most nearly comply with all of the requirements of these specifications.

20. The following items are considered of vital importance:

	See paragraphs
(a) Low gear reduction	30 and 212 to 219
(b) Large size engine	35 to 109
(c) Four speed transmission	212 to 219
(d) Maximum ground clearance	31
(e) Demountable tires of sizes specified	249 to 257
(f) Large gasoline tank	103 to 109
(g) Electric lighting system	119 to 176
(h) Three-point engine suspension	94
(i) Locking differential	229 to 233
(j) Best quality alloy steel springs	258 to 279
(k) Gage of wheels	34
(l) Large radiator	109 to 117
(m) All data and drawings required must be submitted	11 to 17 and 279

21. GUARANTEE: Each bidder will be required to guarantee his vehicle or vehicles against defects in material or workmanship for a period of one year. This guarantee shall include the delivery of the defective part or parts to any point in the United States. After the installation of the new part, the defective part will be returned to the manufacturer if he so requests. The manufacturer will pay the transportation charges on all returned parts.

22. The above guarantee shall also apply to all parts and accessories which are not made by the bidder.

23. TESTS: The Department may call upon manufacturers of trucks for such tests as it may consider necessary to procure trucks that will fully withstand, in all respects, the severity of military service. Bidders and prospective bidders should write the office of the Quartermaster General of the Army, with a view to determining the extent to which practical tests will be applied.

Description

24. LOAD CAPACITY: The trucks must be of sufficient strength, and provided with sufficient power, to carry and propel the following gross load under the most severe service conditions:

Pay load	3,000 lb.
Body	1,050 lb.
Three men	525 lb.
Extra equipment	200 lb.
Total	4,775 lb.

The extremely severe service conditions under which these trucks will be operated indicate that they should be designed for a nominal pay load of 4000 pounds.

25. LOAD DISTRIBUTION: The distribution of load between front and rear axles, with the normal pay load equally distributed in the standard truck bodies herein specified, shall be not less than 80 per cent nor more than 95 per cent of the rear wheels in two-wheel drive trucks. In four-wheel drive trucks the total weight of the loaded vehicle shall be as equally divided as possible between the front and rear wheels.

26. WEIGHT OF CHASSIS: The maximum weight of chassis, without body or extra tool and parts equipment, and without gasoline, water, or oil, must be not more than 6000 lbs: A definite statement must be made showing exactly what equipment is included in the stated weight.

27. ROAD SPEED: The governor on engine shall be set so as to give a road speed of 15 miles per hour, with a maximum engine piston speed of 1100 feet per minute.

28. TYPE OF DRIVE: The trucks may be provided with any suitable standard type of drive, such as internal gear, bevel gear, worm gear, or chain drive. Preference will be given to that type of final drive which provides the greatest amount of ground clearance, in conjunction with provision for retaining grease or oil and excluding dirt.

29. Either two-wheel drive or four-wheel drive may be employed.

30. TRACTIVE EFFORT: The tractive factor obtained by dividing the net tractive effort at the tire surface of the driving wheels by the total weight of the fully loaded truck shall be not less than .0775 on high gear, and not less than .338 on low gear. This tractive effort shall be based on 85 per cent efficiency of power transmission from engine to drive wheels on high gear, and on 70 per cent efficiency of power transmission from engine to drive wheels on low gear.

31. GROUND CLEARANCE: The ground clearance at all parts of truck, except at drive sprockets and hub brake drums, shall be not less than 9¾ inches. The ground clearance at the center of truck between front and rear wheels shall be not less than 18 inches, and the difference between this center clearance and the axle clearance may be decreased in proportion to the distance from the center of the truck. The clearance under engine pan shall be not less than 11 inches.

32. WHEEL BASE: The wheel base must be suitable for the use of a 10-foot body, and shall be not less than 124 inches nor more than 150 inches.

33. TURNING CIRCLE: The truck shall be so designed as to turn in a circle of not more than 55 feet, measured from outside wheel tracks. Positive stops must be provided to limit the steering angle of the steering wheels.

34. GAGE: The gage of wheels on 1½-ton trucks, measured from center to center of felloe bands, shall be as follows:

4-in. single tires	58½ in.
6-in. single tires	60½ in.
(Used on 4-wheel drive)	
7-in. single tires	61½ in.

Engine and Cooling System

35. ENGINE: The engine must be of the 4-cycle type, water-cooled, having not less than four cylinders, and provided with mechanically-operated poppet valves. It shall have a total piston displacement of not less than 312 cu. in. and must develop a torque of not less than 2000 inch pounds at not more than 1,000 ft. of piston speed per minute. The torque at 500 ft. of piston speed per minute shall be not less than 90 per cent of the maximum torque. The engine must be under a removable hood, and located in a readily accessible position. The hood must be waterproof, readily removable without removing screws or bolts, and must open up sufficiently wide to permit of easy access to engine for inspection or adjustment. All main and connecting rod crank bearings shall be so designed as to be easily adjusted to take up wear. The piston pin bearing shall consist of a suitable phosphor bronze bushing properly secured in the connecting rod end. The valve stem guides and push rod guides shall not be cast integral with the cylinder casting, but must be separate parts, properly secured in place. The lower half of the crank case must be removed without disturbing the main bearings or the clutch housing, or removing the engine from the chassis. The unit power plant type of construction will not be permitted. The transmission must be mounted as a separate unit.

36. CYLINDERS: The cylinders shall be cast from best quality grey iron, and must be free from sand holes, blow holes, cold shuts, or other imperfections. The bore of finished cylinders must be the same diameter from end to end, and finished to a tolerance of plus or minus 0.0005 in., for diameter and eccentricity.

37. The water jackets of cylinders must be tested under a hydrostatic pressure of 100 lb. per square inch, which test they must withstand without leaking.

38. The cylinders must be rigidly bolted to the crank case by means of a proper number of stud bolts in crank case, and double nuts, or single long type of tight fitting nuts. The stud bolts must accurately fit the holes in cylinder casting, the diameter of the hole being not more than 1/32-in. greater than the diameter of the bolt.

39. The water passages in jackets shall be of large area and volume, must extend entirely around the valve seats, and must offer as little obstruction as practicable to the flow of water. The water passages shall be so designed as to secure a uniform flow of water through all parts of the jacket. The water must circulate freely between the cylinders and the jackets must be free from air pockets, or dead ends where the water is unable to circulate freely. The jacket space must be so designed that all water will drain completely from the jackets when the lower drain

cock on radiator or water circulating system is opened.

40. The compression space in each cylinder must be accurately calibrated and the cylinders selected so that the clearance volume of each cylinder is the same as that of any other for the same engine within 1 cu. cm.

41. PISTONS: The pistons shall be designed and constructed in accordance with the best standard practice. They shall be light in weight, heavily ribbed to secure proper strength, and made of best quality gray cast iron, free from blow holes, sand holes, shifted cores, or other imperfections. They shall be properly annealed, machined with light cuts to avoid distortion and ground to a high finish, proper tolerance, and a suitable clearance in cylinders.

42. The clearance between maximum diameter of piston and the diameter of cylinder bore shall not be less than 0.003 in. nor more than 0.005 in. They shall be properly tapered or relieved at the head end to provide for expansion, and shall have an internal stiffening flange at the open end.

43. Suitable means must be provided for preventing an excess of oil from working past the piston rings and into the combustion space, and at the same time securing proper lubrication of the piston and all bearings connected with the crank case.

44. The pistons shall be of such length as to give a low bearing pressure on the cylinder walls. The piston must also be so designed and constructed as to avoid slapping at all loads and governed engine speeds.

45. The pistons complete with rings and piston pins must be selected for weight, so that each piston will be the same in weight as any other piston for the same engine, with a tolerance of plus or minus ½ ounce.

46. PISTON PINS: The piston pins shall be hollow, with a wall of proper thickness. They shall be made of steel of suitable quality for the purpose, properly hardened, and ground to a high finish and proper tolerance. The harness of piston pins shall not be less than 470 Brinell, as a base for comparative scleroscope readings.

47. The piston pin shall be a light driving fit in both of the piston bosses. The piston pin shall be fastened only in one piston boss, and the fastening must be made by an approved device which will positively lock the piston pin in the piston boss, and prevent it from coming loose.

48. PISTON RINGS AND GROOVES: The piston shall be provided with at least three ring grooves of proper width and depth, all located between the wrist pin and the head end of piston. These grooves shall be ground to a high finish at the sides. Piston ring grooves to be finished as in S. A. E. practice.

49. If the triple type of ring is used, having one internal ring and two external rings, two ring grooves may be used, each provided with a triple ring, or one groove may be provided with a triple ring and the other with the ordinary type of single ring.

50. The single rings shall be machined to a high finish and proper tolerance on outside periphery, and ground on sides in accordance with S. A. E. recommended practice.

51. The rings must be of proper tension, and installed with only sufficient opening between the ends to provide for expansion of the rings under maximum temperature conditions.

52. VALVES: The intake valves and exhaust valves must be interchangeable, and made of alloy steel of best quality for the purpose.

53. The complete composition of the steel must be stated definitely, and all valves must be heat treated to develop the proper physical properties.

54. The valves must be ground to a thoroughly gas-tight fit in the valve seat.

55. The valves must be constructed of one piece for both stem and head, must have a large radius fillet between the stem and head, and must be provided with 45 degree seats.

56. All parts of valve mechanism must be completely inclosed. If the engine is of the L-head or T-head type, the valve springs, stems, and tappets must be inclosed by a suitable readily removable cover plate, and if the engine is of the valve-in-head type, the over-head valve mechanism must be completely inclosed with a suitable readily removable cover, or the bearings for rocker arms must be provided with suitable felt washers to prevent the entrance to dust or dirt.

57. VALVE TIMING: The flywheel of engine must be provided with marks, referred to a readily observable pointer or reference mark, showing the upper dead center, lower dead center, and the opening and closing positions of both inlet and exhaust valves, for each cylinder.

58. VALVE STEM GUIDES: The engine shall also be provided with suitable pressed-in or bolted-in valve stem guides. The use of valve stem guides cast integral with the cylinders will not be permitted.

59. VALVE SPRINGS: The springs for both intake and exhaust valves shall be made of best quality steel, of proper strength for the maximum speed of the engine, and designed so as to withstand a long period of service without sagging or breaking. These springs shall be heat treated to develop the proper physical properties.

60. VALVE LIFTERS: The valve lifter must be made of the most suitable steel and of proper design, with glass hard wearing surfaces (not less than 90 scleroscope). It must have a suitable adjustment for height, which is easily accessible, and which will retain the adjustment and not shake loose. The adjusting device must be strong enough to withstand heavy strains with a wrench in adjusting without distorting or stripping of threads.

61. VALVE LIFTER GUIDES: The engine shall be provided with suitable valve lifter guides of proper material, which will be either bolted or pressed into the crank case. The use of valve lifter guides cast integral with the crank case or cylinders will not be permitted.

62. CONNECTING RODS: The connecting rods shall be of I-beam section, drop forged from steel equal to S. A. E. steel No. 1035, and properly heat treated.

63. The crank end of the connecting rods shall be provided with bronze bushings faced with a proper thickness of best quality bearing metal.

64. These bearings shall be scraped to a proper fit with the crank, and in proper alignment at all positions of the crank, and for two-bolt rods shall be held in place with suitable doweling. The bearing shall be provided with proper grooves and oil holes for lubrication.

65. The bearing on piston pin shall be in the connecting rod end, and a suitable solid phosphor bronze bushing, pressed in, shall be used.

66. The bearing at each end of connecting rod shall be large enough to withstand long periods of severe service without the necessity of replacement or adjustment.

67. The cap end of connecting rod shall be made of the same material as the connecting rod, and shall be held to the rod and bearings by means of suitable bolts made of best quality alloy steel equal to S. A. E. specification No. 2330, or 3130, properly heat treated to give an elastic limit of 80,000 pounds per square inch minimum, reduction of area 55 per cent minimum, and elongation 18 per cent in 2 inches minimum, provided with suitable castellated nuts and cotter pins.

68. The complete connecting rods for each engine must be selected for weight, so that each connecting rod shall be of the same weight as that of any other connecting rod for the same engine, with a tolerance of plus or minus one-half ounce. The crank ends of connecting rods, and also the piston pin ends, must weigh the same with a tolerance of plus or minus one-fourth ounce.

69. CAM SHAFT: The cam shaft shall be constructed of S. A. E. steel No. 1020 or alloy steel of best quality for the purpose, the cams properly case hardened, and both the cams and bearings ground to a proper finish and size.

70. The cams must be forged integral with the cam shaft, and the bearings shall be of such size as to permit the shaft to be removed without removing the bearings, or the bearings must be readily removable with the cam shaft. The gear connection for cam gear shall be a flange, which is forged integral with the cam shaft and provided with a central boss for centering the cam gear.

71. The cams shall be designed and ground to such shape as to secure quiet operation of the engine and maximum torque, and shall have wide bearing faces in order to prevent undue wear of the cams or valve lifters.

72. CAM SHAFT BEARINGS: The cam shaft shall be provided with not less than three bearings for a four cylinder engine. The cam shaft bearings shall be of the best quality phosphor bronze or equal bearing metal. They shall be provided with an effective means

for securing a proper circulation of oil through the bearings from the pressure oiling system.

73. GEARS: The cam shaft gear may be of cast iron, but the smaller gears on crank shaft and on magneto, generator and pump shaft must be of steel. These gears must be machine cut, and all gears accurately adjusted to a quiet running fit under load. They must also have sufficient width to insure long wearing life. The cam shaft gear connection may be adjustable in order to permit proper valve timing, but must be provided with suitable means for retaining the adjustment.

74. CRANK SHAFT: The crank shaft shall be forged from a single piece of steel, equal in quality to S. A. E. specifications No. 1045, and heat treated to develop the following minimum physical properties:

Brinell hardness 250-275 (Scleroscope 41-45).

Reduction of area 45 per cent.

Elongation 16 per cent in 2 in.

75. The crank shaft shall be sufficiently large in section at all points to prevent objectionable torsional or lateral vibration at all practicable engine speeds and loads.

76. Both crank bearings and main bearings shall be large in area in order to give low bearing pressures and long bearing life without replacement or adjustment. The crank shaft shall have not less than three main bearings for a four cylinder engine.

77. The crank pins and main bearings of crank shaft must be ground to a high finish and a total tolerance of 0.0005 in. for eccentricity, and a tolerance of plus or minus 0.0005 in. for diameter.

78. The crank shaft must be accurately balanced for static and running balance, at the governed speed of the engine.

79. Suitable means must be provided for preventing cylinder oil from creeping out of the crank case at the end of bearings, or at any other part of the crank case.

80. The flywheel flange must be forged integral with the crank shaft. This flange must be large in diameter and so designed as to secure an accurate centering of the flywheel on the flange. The bolts used in fastening the flywheel to crank shaft shall be of suitable diameter, and of material equal to S. A. E. specification No. 2330 or 3130, properly heat treated to give an elastic limit of not less than 80,000 lb. per square inch, reduction of area of 40 per cent minimum, and an elongation of 16 per cent in 2 in. minimum. For inspection purposes these bolts must have a scleroscope hardness of not less than 35 nor more than 42. If the bolts take the driving strain they shall be of large diameter and tightly fitted in reamed holes in both members.

81. CRANK CASE: The crank case is to be divided in a horizontal plane, with all bearings in the upper section. It must be so designed as to be light in weight and also of proper strength, and must be provided with suitable ribbing in order to secure a strong case free from distortion or weakness, and without excessive weight. It should be so designed as to permit any piston to be removed from its cylinder and taken out of the case without removing the cylinder or crank shaft.

82. All oiling receptacles, pipes, and oil guides, except the constant level troughs for connecting rods, shall be either pressed or cast integral with the crank case, or the oil pipes may consist of external leads. If external leads are used, they shall be short and rigid, or properly clipped to prevent vibration and chafing.

83. The oil settling chamber on engine must be provided with a suitable threaded plug for draining. The use of a drain cock will not be permitted.

84. The crank case must also be provided with an effective oil level indicating device, of the bayonet blade type.

85. The crank case must be a smooth casting, free from defects of material, design or construction.

86. All joints or connections in crank case shall be made thoroughly oil tight.

87. The bearings shall consist of heavy split bronze bushings, and one set of these bushings shall be provided with side flanges to take end thrust. These bushings shall be faced with a suitable thickness of best quality bearing metal, and provided with proper oil grooves. The bearing cars shall be of proper design, and made of material suitable for the purpose. These caps shall preferably be held in place by means of alloy steel bolts of proper size provided with castellated nuts, with suitable cotter pins. Not less than three main bearings shall be provided in a four cylinder engine.

88. The main crank shaft bearings and the connecting rod bearings shall be finished to an accurate bearing surface.

89. The main and connecting rod bearings shall be provided with laminated metallic shims, made up of sheets of equal thickness. The shim sheets shall be not more than .0015 inch in thickness.

90. OIL CAPACITY: The oil reservoir of engine must have sufficient capacity for lubricating oil to permit the truck to run fully loaded a distance of not less than 200 miles over ordinary roads without replenishing the supply of oil.

91. The oil filler and breather tubes on crank case shall be provided with a non-removable, fine mesh, brass screen, and also another screen of same construction which is removable. The filler tube cap shall be hinged and provided with a spring which will hold it in the closed position. This cap must not permit the entrance of water, and must also have a sufficiently large opening to properly vent the crank case.

92. LUBRICATING SYSTEM: The engine shall be lubricated by a pressure oiling system. The oil pump must be positive driven and provided with suitable screens of not less than 30 mesh, and which are readily removable for cleaning. It is desirable that the oil pump and screens be so arranged as to make the screens self-cleaning by an intermittent reverse flow of oil. The inlet to oil pump must be a sufficient distance above the bottom of oil reservoir to provide a suitable settling chamber.

93. The oil pump must deliver a large volume of oil, and must maintain a pressure of not less than 30 pounds per square inch, at an engine speed of 800 r.p.m. A suitable relief valve on the oiling system must be provided.

93a. FRICTIONAL HORSE POWER: The engines furnished with trucks must be thoroughly "run-in," so that the trucks may immediately after delivery be placed in continuous severe service without danger of damage to the engines. When the trucks are delivered the engines must be in such condition that the power required to drive any engine at 1000 feet of piston speed, and with the fan and pumps in operation, shall not exceed 16 per cent of the rated horsepower of the engine with wide open throttle at the same speed.

94. SUSPENSION: The engine must be mounted with a three-point suspension, or on a sub-frame having a suitable three-point suspension which will effectively prevent the distortion of the frame from straining any part of the engine, clutch, or transmission.

95. STARTING CRANK: The starting crank must be readily accessible, and located in such a position as to be protected against damage from minor collisions. If necessary, it may be of the folding type. The removable type of starting crank will not be acceptable.

96. The engine and starting crank must be so mounted that the extreme distortion of the frame of truck will not prevent the ready engagement and operation of the starting crank.

97. GOVERNOR: A centrifugal type motor speed limiting governor of approved make shall be provided and adjusted so as to prevent the truck from exceeding a speed of fifteen miles per hour on high gear. The governor shall be adjustable and must have provision for sealing the adjustment and all connections of drive shaft with suitable lead seals.

98. ENGINE SHIELD: Suitable means must be provided to protect the carburetor, magneto, and generator from water and mud. If a removable shield is used it must be fastened by means of spring clips which will permit it to be removed with the hands only, and without tools of any kind. In case the engine crank case is provided with cast or stamped webs equally as effective as the engine shield herein described, the engine shield will not be required.

99. CARBURETOR: The carburetor must be of such design, and provided with such heating devices, as will enable it to utilize gasoline having an initial boiling-off temperature of not less than 122 deg. Fahr., a 25 per cent boiling-off temperature of not less than 230 deg. Fahr., a 50 per cent boiling-off temperature of not less than 300 deg. Fahr., a 90 per cent boiling-off temperature of not less than 350 deg. Fahr., and a dry point temperature of not less than 400 deg. Fahr. The engine must utilize gasoline of the grade mentioned above, and at the same time operate with satis-

factory economy and regularity at all engine speeds and loads.

The carburetor and engine intake manifold must be provided with S. A. E. standard flanges.

100. The carburetor should be adjustable, and provided with means, readily accessible from the driver's seat and from the cranking position, for enriching the mixture when starting. The mixture must not be enriched by depressing the float, but this must be accomplished by the air control or the operation of the needle valve. If the mixture is enriched by the operation of the needle valve, the original carburetor adjustment must not be changed. A suitable drain cock must be provided at the bottom of the float chamber. The intake manifold must be provided with a suitable water jacket, and the carburetor must be installed in as high a position as practicable. The use of aluminum in the construction of the carburetor will not be permitted.

101. DUST COLLECTOR: A dust collector of suitable design and construction must be installed and connected with the carburetor main and auxiliary air intakes. It must be readily accessible for cleaning. It is desirable that the crank case breather tube be connected with the dust collector in order to prevent dust from entering the crank case.

102. MUFFLER: The muffler must be of substantial construction, and so designed as to give the minimum back pressure and effectively muffle the exhaust. It must be so constructed and installed as to be readily taken apart for cleaning. The final exhaust not to be directed downward. The muffler must be provided with a suitable cut-out, with a spring which will hold the muffler valve positively in either the open or the closed position. The cut-out must not be operable from the driver's seat. The muffler must be located in such a position forward of the rear axle as to make it impossible for it to be knocked off due to the truck dropping into deep ditches, or passing over high ridges.

103. GASOLINE TANK: A suitable drawn steel gasoline tank, with welded joints, shall be provided, having a capacity of not less than thirty gallons. This tank shall be thoroughly tinned both inside and outside. Tanks with soldered joints will not be acceptable.

104. A metal partition shall be installed on the inside of tank of such height as to give a capacity of six gallons on each side of the partition. Suitable baffle plates shall be installed on each side of partition in order to prevent excessive splashing. The connection from tank to carburetor shall be made from the bottom of each compartment, through a three-way cock, thus giving a positive reserve supply of six gallons. A readily accessible shut-off valve shall also be provided in the gasoline supply line to carburetor.

105. If a pressure system is provided, the three-way cock may be installed at the top of tank with the supply pipes extending from same to the bottom of each compartment in tank.

106. A suitable gasoline strainer with drain cock shall be installed in a readily accessible location, and in the gasoline line between the tank and carburetor. The gasoline pipe line and pressure tubing shall consist of thoroughly annealed brass or copper seamless tubing, not smaller than ⅜ of an inch outside diameter, properly fastened at suitable intervals to prevent vibration or chafing, and arranged so as to completely drain through either the tank, carburetor, or strainer. All fuel and pressure pipe connections are to be S. A. E. standard fittings.

107. Suitable means must be provided for draining the gasoline from a flooding carburetor on to the ground without permitting any gasoline to get into the engine pan or to accumulate on any part of the chassis.

108. The gasoline tank must be installed high enough to permit the gasoline to flow to the carburetor when the truck is climbing the maximum grade which it is capable of negotiating under the most favorable road conditions, and with the minimum amount of gasoline in the tank. If necessary, a pressure feed system may be employed. The tank must be provided with a mounting which will prevent straining the tank due to frame distortion.

109. COOLING SYSTEM: The cooling water must be pump circulated, and the system must be so designed that it may be completely drained by opening a single drain cock. The drain cock must have a free opening not less than one-fourth inch in diameter, and must be located in such a position as to permit the water to run directly into a bucket placed under the drain cock. Thermo-syphon systems will not be acceptable. The water pump must be of such design as to permit thermo-syphon circulation in case of pump failure. The use of the gear type of pump will not be permitted.

110. The radiator must be of such design as to insure uniform and free circulation of water, and mounted in such a manner as to prevent damage to radiator due to severe vibration or twisting of the frame. It must also be readily repairable without special equipment. A tie rod with universal connection at the radiator end must be fitted.

111. All parts of radiator in contact with water shall be thoroughly tinned. Suitable baffle plates shall be provided in order to secure a uniform circulation of water through the entire radiator.

112. Ample area for the circulation of air through the radiator shall be provided and also proper outlet area shall be provided to permit the free passage of the heated air away from the rear of engine. Suitable louvres shall also be provided in each side of engine hood. The hood should be supported independently of the radiator.

113. The radiator shall be of the fin and tube type, having cast or pressed upper and lower headers, with bolted-on cooling section or sections. If the cooling section consists of individual tubes with fins, the tubes must be not less than ⅜-inch outside diameter. If the fins are continuous, the tubes may be a minimum of one-fourth inch in diameter. The overflow pipe must be of copper or brass, and not smaller than ⅜-inch tubing.

114. The radiator shall have a frontal area involving section only of not less than 2.25 square inches per square inch of piston swept surface, and a total radiating surface in radiator of not less than 90 square inches per square inch of swept surface. The piston swept surface shall be obtained by multiplying the circumference of cylinder bore by the length of stroke, by the number of cylinders.

115. RADIATOR HOSE: The distance between the ends of radiator hose connections and ends of hose connections of engine shall be not less than .3 of the distance from the center of third point of support to the center of the hose connections of engine. The connections for hose on both engine and radiator must be not less than 2 inches in length. Both the upper and lower radiator hose must be non-collapsible.

116. A suitable fan and fan housing shall be provided which will cause a rapid circulation of air through all parts of the radiator, and insure proper cooling of the circulating water. The fan pulley and fan belt driving pulley must be so arranged as to permit of the ready replacement, adjustment, or removal of the belt. The fan belt and fan pulley must be constructed in accordance with S. A. E. standards. The belt shall be 2 inches in width, and provided with a spring take-up.

117. It is desired that the magneto, generator, coil, timer, battery and muffler be kept as high as practicable.

118. STARTING MOTOR: Suitable provision must be made either on the engine or elsewhere, for the installation of a starting motor, of proper size and design. The starting motor is not to be furnished, but the truck must be so arranged as to readily permit of its installation at any time if so desired. The flywheel must be provided with gear teeth for use with the starting motor. These gear teeth must be cut in accordance with S. A. E. recommended practice.

119. ELECTRIC LIGHTING AND IGNITION: The truck must be provided with a suitable electric lighting system and dual ignition system. The electric lighting system shall consist of a generator driven from the power plant, a reverse current voltage cut-out, 100 ampere hour, 3 cell, lead acid battery, or 75 ampere hour 5 cell nickel-steel alkali battery, electric lights, fuses, wiring and other necessary details. The ignition system shall consist of a high tension magneto of best make, and a battery and coil ignition system. One distributor and one set of spark plugs may be used in common with the two separate ignition systems. The current for battery ignition will be taken from the electric lighting battery. Both battery ignition and magneto must be readily controlled from the driver's seat, and the spark advance lever on steering wheel must control both ignition systems, and give a suitable degree of spark advance for all positions of the spark ad-

vance lever. The range of spark advance shall not be less than 30 degrees of crank angularity. The full retard position of the spark lever shall retard the battery spark at least 3 degrees after top center.

120. If the high tension magneto or generator is coupled to a driveshaft, two universal joints or a flexible coupling must be used in the driving connection, in order to prevent binding of bearings. The flexible coupling, if used, must provide for parallel and angular displacement.

121. GENERATOR: The generator shall be of the fully inclosed direct current, constant voltage, type, and must have a continuous capacity of 12 amperes. The voltage of the generator when installed on the truck shall be 8 volts at 1 ampere, and 7 volts at 12 amperes, within limits of plus or minus .2 volt. The voltage regulation must be the same with varying engine speeds, up to governed engine speed. It must be driven from the engine by means of suitable gears or silent chain drive. The gears or silent chain drive must be completely inclosed, thoroughly lubricated, and effectively protected from dust and dirt. If driven by means of silent chain drive, the chain must be readily adjustable. Definite data in reference to the material and construction of chain drive gears must be given.

122. ARMATURE: The armature shall be of the laminated drum type, with the windings thoroughly insulated, and so installed in the slots as to effectively resist the action of centrifugal force at the maximum guaranteed speed of armature. After the coils are properly secured in the slots and the armature coil terminals are securely soldered into slots in the ends of commutator segments, the entire armature shall be treated with an insulating compound by a suitable impregnating process. The insulating compound shall have suitable insulating qualities, and shall not soften under a continuous temperature of 250 degrees Fahrenheit. The armature shall also be of proper electrical, magnetic, and mechanical balance.

123. Suitable means must be provided for preventing oil from the bearings from collecting on the commutator or armature.

124. Suitable anti-friction or sleeve bearings of best quality shall be fitted in each of the end frames. The bearings shall have proper means for ready lubrication, shall be a proper fit on the armature shaft, and shall not be so loose as to cause vibration of the armature at any practicable engine speed. The ratio of engine to generator speed must be given, and also the maximum permissible speed of the generator. The generator must be run at a constant ratio of engine speed, and no friction drives or constant speed devices will be permitted. The speed of generator in any case must not be more than twice the engine speed. The generator drive connection must be made direct with the engine, or with some part of drive connection between the engine and clutch.

125. The brushes of generator must be the self lubricating type, having a spring take up which will give a proper tension on the brush during its entire wearing life. The brushes must be easily accessible and readily removed or replaced without removing or loosening other parts, and must have ample area of cross-section and area of contact to prevent excessive heating under continuous maximum permissible load. The brushes must be practically sparkless at all speeds, and at all loads from no load to maximum permissible load.

126. COMMUTATOR: The commutator must be constructed of best quality hard copper of uniform density, and the segments properly insulated with sheet mica or micanite of suitable thickness and proper density to wear equally with the copper segments. The mica between segments shall be undercut approximately 1/32-inch.

127. REGULATION: All voltage and current regulating devices shall be contained in assembly with the generator. No separately mounted controlling devices will be permitted. The use of sliding contact devices for current or voltage regulation and the use of permanent magnets in the construction of generator is also prohibited. If a voltage regulating device is used it must be provided with suitable seal.

128. CHARGING SPEED: The generator shall begin to charge the battery at an engine speed of not more than 500 r.p.m., and at the same time furnish the current necessary for ignition.

129. HIGH TENSION MAGNETO: A high tension magneto of best make must be installed on the engine, and positively driven either by gears or by a silent chain drive. If driven by gears, the gears must run in oil, and if driven by silent chain drive, the chain must be readily adjustable. In either case the chain or gears must be completely inclosed and thoroughly lubricated. The magneto must be arranged for clockwise rotation. Both the magneto and the mounting for same must be constructed in accordance with S. A. E. recommended practice.

130. The magneto must be provided with a suitable waterproof cover of proper construction, arranged so as to be securely fastened around the magneto and readily removable.

131. The magneto must be so designed as to exclude dust, water and dirt, and must be provided with a suitable water and dust proof cover of proper material and construction, and arranged so as to be securely fastened around the magneto and readily removable.

132. One distributor may be used in common for both battery ignition and for the magneto. The distributor must be of the waterproof type and provided with a suitable safety gap.

133. The breaker points must be of platinum-iridium, and the breaker box and contacts must be easily accessible and readily adjustable. The breaker box must completely inclose the breaker mechanism, and prevent the entrance of dust, water or dirt.

134. The magneto must be provided with a suitable spark advance arrangement, which will enable the magneto to deliver an adequate strength of spark at all positions of the spark advance lever. The definite range of spark advance must be given in the proposal, and must not be less than 30 degrees of crank angularity. The breaker box must be reversible or provided with two levers on opposite sides.

135. The sector for spark advance lever must be plainly marked START and RUN for the most suitable battery starting and running positions.

136. With battery ignition the strength of spark must be adequate for all engine speeds, and the spark lag must be as small as practicable. The definite amount of spark lag in degrees of crank angularity must be given for all engine speeds, with a fixed setting of the spark advance lever.

137. Complete details of the construction of the magneto, with drawings and illustrations, must be submitted with proposal.

138. The guaranteed length of spark between needle points must be given with engine running at 100 revolutions per minute, and for both battery ignition and high tension magneto the lag of spark in degrees of crank angularity must be given for all practicable engine speeds.

139. The primary and secondary cable shall be constructed and tested in accordance with the latest recommendations of the Society of Automobile Engineers.

140. TINNING TEST: All copper wires must withstand the following tinning test: Samples will be properly selected to secure an average grade of tinning. The samples will have the insulation carefully removed, and the wires of cable carefully separated and straightened. The wires will then be thoroughly cleaned by means of ether, benzine, gasoline, naphtha, caustic alkali solution, or hot water and soap, whichever may be found necessary to thoroughly clean the wires.

141. The wires shall then be rinsed in clear water and wiped dry with a soft cotton cloth. The wires will then be immersed for one minute in a solution of hydrochloric acid having a specific gravity of 1088 at 70 deg. Fahr. and then rinsed in clear water and wiped dry as above specified. The wires shall then be immersed for 30 seconds in a solution of sodium polysulphide having an excess of sulphur, then rinsed in clear water and wiped dry.

142. The complete cycle of operations shall then be repeated, commencing with the immersion in hydrochloric acid and ending with the immersion in the sodium polysulphide solution.

143. Tests of tinning will be made on not less than ten sets of samples of reasonable length. All wires must withstand one immersion in the hydrochloric acid without blackening in the sodium polysulphide solution, and 75 per cent of the wires must withstand three immersions in the hydrochloric acid without blackening in the sodium polysulphide solution. All tests shall be conducted with the solutions at a temperature of 70 deg. Fahr.

144. LIGHTING EQUIPMENT: The

truck shall be provided with the following lighting equipment:

1—Searchlight, with quick acting vertical and horizontal adjustment, silver plated brass or copper parabolic reflector, or glass parabolic reflector silvered on the back, with 21-c.p. tungsten focusing bulb.
2—Side lamps, combination oil and electric, with 8-c.p. 6-8 volt tungsten bulbs.
1—Electric instrument lamp, with 2-c.p., 4-volt bulb, and one combination oil and electric tail lamp with 2-c.p. bulb, connected in series.
1—Portable trouble lamp, 8-c.p., with cord, and plug with separate socket.
1—Ammeter of best make, for indicating the charge and discharge of battery.

145. SEARCHLIGHT: The searchlight shall be not less than 10½ inches in diameter outside of front flange. The body of lamp shall be spun or pressed from one piece of heavy brass, copper, or steel. In the design of the lamp no parts shall be used which are liable to shake loose from vibration. The reflector shall be parabolic in form, spun or pressed from brass or copper of suitable thickness, and heavily silver plated. The reflector may be of glass, silvered on the back. The searchlight shall be of dustproof construction.

146. The searchlight shall be provided with a suitable handle, and means for clamping the searchlight securely in any desired position. The searchlight shall be installed on the chassis in a location permitting it to be readily operated from the driver's seat, and also in such a position as to be unobstructed from the front.

147. This lamp shall be provided with a single point bayonet socket with two wire connections, and a suitable focusing device.

148. SIDE LAMPS: The two side lamps shall be best quality combination oil and electric, of suitable design and construction, and fitted with standard S. A. E. single point, grounded return sockets, and 15-c.p. 6-8 volt tungsten bulbs. The oil fonts shall be so designed that they cannot rattle or drop out. These lamps shall be made of heavy gage sheet steel or brass, thoroughly riveted and soldered, fully black enameled, and fitted with forged steel yoke brackets or installed in dash. They shall have large glass semaphore front lens.

149. The instrument light socket shall be the single point type with two terminals for wires. One terminal will connect with source of current supply, and the other will connect with a wire leading to the one point grounded tail light socket, thus putting the instrument light and tail light in series.

150. TAIL LAMP: The tail lamp shall be the same as specified for side lamps, except that the large semaphore lens shall be of red glass colored in the glass composition, and the side glass may be omitted. The bulb shall be 2-c.p., 4 volt, connected in series with bulb of the same size and rating in instrument lamp. The tail lamp bracket shall be made of forged steel, and shall be located in such a position as to prevent it from being knocked off due to collision, or to the rear wheels of truck dropping into deep ditches.

151. TROUBLE LAMP: The portable trouble lamp shall consist of a suitable hardwood handle through which the cord shall pass, and provided with an S. A. E. standard, single contact socket, with two connections for wires, a lamp guard of proper design, and an 8-c.p., 6-8 volt tungsten bulb. The other end of cord shall be provided with a suitable single point combination plug for connecting with a ground return socket. The cord shall be No. 14 B & S gage, flexible, twin-conductor, rubber covered, double braided, packing house cord of best make. The portable trouble lamp shall be provided with an S. A. E. standard, single point, flush type, flanged socket, installed in a readily accessible location, preferably on the dash, and connected with the lighting switch.

152. AMMETER: Furnish and install in a suitable location a flush type ammeter of best make, having a double scale for indicating the charge and discharge current of battery, and provided with a black dial bearing white figures. It shall be installed in such a location as will permit it to be readily observed from the driver's seat, and properly illuminated by the instrument light.

153. This ammeter shall be connected in the circuit leading from the negative terminal of battery. The ammeter must be so designed as to not be affected by severe vibration. It must have a light moving system and be dead beat in action. It must be thoroughly insulated, and be so designed as to avoid short circuits due to the loosening of parts.

154. EXTRA LAMP BULBS: The following extra lamp bulbs shall be provided, installed in a suitable metal case:

2—21-c.p. 6-8 volt tungsten bulbs of best make, with single point Ediswan bases.
4—8-c.p., 6-8 volt, tungsten bulbs of best make, with single point Ediswan bases.
2—2-c.p., 4 volt, tungsten bulbs of best make, with single point Ediswan bases.

155. The bulb case shall be of heavy seamless steel, with a heavy seamless steel hinged cover with automatic spring catch. The bulbs shall be held securely in place by means of brass springs and a suitable locking device. The case must be of proper size to hold the above lamps without the lamps touching each other or the sides, top, or bottom of the case. The case shall be thoroughly coated, both inside and outside, with best quality black enamel.

156. WIRING: The trucks shall be wired with the system of installation known as the ground-return system. In this system of wiring the chassis frame or bare metal is used as the return circuit. All ignition wiring must be protected from water and oil, and mounted in such a manner as to prevent chafing.

157. All wring and electrical equipment shall be constructed, installed, and tested, in accordance with S. A. E. recommended practice.

158. CONDUIT: Whenever practicable the wires shall be carried in either rigid or flexible metallic conduit. The flexible conduit is preferred. The conduit shall be securely fastened by means of galvanized straps and galvanized machine screws of proper size. The ends of the conduit must point downward so that water will not run into the conduit.

159. CLEATS: Where wires are not protected with conduit they shall be securely cleated at intervals of not more than 10 inches. Such cleats shall be of galvanized steel of proper thickness and width, and secured with suitable screws. Galvanized steel machine screws in tapped holes shall be used in all cases where the fastening is to be made on metal.

160. FUSE BOX: A four-circuit fuse box of proper design shall be installed in a readily accessible location.

161. The fuse box shall be of best make, and constructed of molded insulating material in both box and cover, or the box and cover may be of black enameled steel suitably lined with a proper insulating material. The wires shall all enter the fuse box from below, and be a snug fit in the opening in box. If steel boxes are used the holes in the box where wires enter shall have suitable insulating bushings, and the fuse clips must be mounted on a base of suitable insulating material, securely fastened to back of box by suitable brass screws. The heads of screws shall be deeply countersunk below the surface of the base.

162. EXTRA FUSES: One complete set of extra fuses will be provided and attached by means of suitable spring clips to the inside of fuse box cover.

163. CIRCUIT BREAKER: If a circuit breaker of an approved type is installed, the fuses herein specified will not be required.

164. SWITCHES: The ignition switch shall be a triple point switch of best make with one point for battery ignition, one point for magneto ignition, and the other point for cutting out the high tension magneto by grounding.

165. The lighting switches shall be the push or pull type of flush switch of best make, mounted in a location readily reached from the driver's seat, and provided with a heavy brass gang switch plate, in dead black finish.

166. GROUNDING: Whenever an insulated conductor is connected to "ground," the connection shall be installed so as to be readily accessible and removable on the completed truck. In all cases where the connection is made to an iron or steel part, the iron or steel shall be thoroughly tinned at the point where the connection is made, and the ground connection shall be firmly maintained by means of screws or bolts with suitable lock washers. Brass or copper lugs of proper size shall be used for all ground connections. The lugs shall be properly soldered to the ends of cables.

167. All cables shall be continuous from connection to connection. The splicing of cables will not be permitted. All cables shall be provided with suitable lugs or terminals wherever practicable. Where the use of terminals is not practicable, the ends of cables shall be tightly twisted, formed into a solid loop of

proper size for the screw connection, and the loop thoroughly soldered.

168. BATTERY: Furnish and install on the truck a 100 ampere-hour, 3-cell lead acid battery of best make, for ignition and lighting only, or a 75-ampere hour, 5-cell, nickel-steel, alkali battery of best make, at the option of the government.

169. The battery shall be installed in a heavy pressed steel case, with waterproof hinged cover with latch. The inside of case must be 6½ inches wide, 16¾ inches long, and 9⅝ inches high.

170. BATTERY TERMINALS: The battery terminals and connections must be so arranged as to prevent the possibility of the battery connections being reversed in relation to the generator terminals.

171. SPARK PLUGS: The spark plugs shall be constructed in accordance with the latest recommendations of the Society of Automotive Engineers, and the large Hexagon type of shell provided with a single sparking point shall be used. The spark plug threads shall be ⅞ inch, 18 threads to the inch.

172. The plug must be provided with a porcelain of best make, packed with suitable copper gaskets and held in place with proper bushings.

173. The center electrode shall be made of metal which will not readily corrode, warp, or be burned by the hot gases, and must be packed thoroughly gas tight inside of the porcelain.

174. The ends of the high tension cable at spark plugs must be provided with suitable terminal properly secured to the cable and spark plug terminals.

175. The seat for spark plug gaskets shall be finished to a smooth and plain surface, and the seat shall be at right angles to the center line of spark plug.

Frame and Body

176. FRAME: The frame shall be constructed of pressed steel or standard rolled structural sections. The frame and suspension must be so designed as to prevent cramping of any part, due to distortion of frame because of uneven road condition.

177. The distance from the back of the driver's seat to the rear end of frame shall be 10 feet. This frame length will permit of sufficient overhang of body to allow the installation of towing hooks and rear bumpers.

178. The frame shall be reinforced at proper intervals with suitable cross members thoroughly fastened to the frame with hot rivets or fitted bolts riveted over nuts. All holes in the frame shall be drilled, not punched. A suitable towing hook shall be attached to each side of the front end of frame. These towing hooks may be installed on the front bumper.

179. The frame shall be provided with two, best quality, dressed oak sills, one bolted on top of each frame side member. These sills shall be the same width as the flange on frame, and shall be of proper depth to give not less than five inches clearance between the rear tires and the side sill of body as shown on drawing Q.M.G.O. T-105. These sills shall be gained over all gusset plates or other irregularities on the frame, and shall be provided with not less than ten sets of body sill fastenings, as shown on drawing Q.M.G.O. T-107, and two angle plates with bolts as shown on drawing of body. The sills shall be painted with three coats of paint of the composition given on drawing.

180. FRONT BUMPER: A spring type of front bumper of suitable design and construction shall be provided, and properly bolted to the front of frame. This bumper must be so arranged as to not interfere with the starting crank. Front towing hooks shall be provided, one at each side of the frame. These towing hooks may be fastened to the front bumper, if arranged in an approved manner. No part of the bumper extending in front of the radiator shall be integral with the chassis frame.

181. REAR BUMPER: A rear bumper shall be provided as shown in detail on drawing T-102.

182. RADIATOR PROTECTORS: Each truck shall be provided with an effective radiator protector, which shall extend the full height and width of the radiator. This radiator protector shall be constructed of heavy structural steel shapes or steel castings, and shall be firmly bolted to the chassis frame. It must be so installed as to not interfere with the starting crank. Complete detail drawings showing the construction of this protector must be submitted.

183. STEERING GEAR AND WHEELS: The steering gear may be either the worm and wheel type or the screw and nut type, and means shall be provided for its thorough lubrication. Adjustments must be possible without removing the steering assembly from the frame.

184. A notched grip moisture proof steering wheel of best quality shall be provided, having an outside diameter of not less than twenty inches. The steering post must be rigidly mounted to prevent vibration, and must be provided with both spark advance and throttle levers.

185. The gear reduction and length of levers on steering gear must be such as to give easy turning action with the fully loaded truck, but the gear reduction must not be so low as to prevent sufficiently quick turning of the wheels in steering.

186. The ratio of movement between the steering hand wheel and the front road wheels shall be such that for 360 degrees travel of the steering wheel the road wheels will move not more than 40 degrees, and not less than 30 degrees about the steering angle pivot, for two-wheel steer.

187. Throughout the steering gear, including all steering connection joints, adequate provision must be made for lubrication.

188. STEERING CONNECTIONS: The steering knuckle tie rod, steering knuckle arms, and steering gear connecting rod, must be located back of the axle in order that the front axle may protect them against damage from obstructions. The steering knuckle tie rod must be straight from end to end, and located as far above the lower edge of axle as possible, and entirely protected by the axle from spring seat to spring seat.

189. All steering connecting rod joints shall be hardened steel sockets, held by springs in close contact with hardened steel balls. The steering cross rod joints may be of the ball and socket or clevis type.

190. LOCATION OF CONTROL: The gearshift and hand brake levers must be placed at the driver's right, with the hand brake lever to the right of the gearshift lever. The hand brake lever is to be pulled back for brake application. The gearshift lever must be fitted with a latch guarding the reverse position.

191. GEARSHIFT LEVER HANDLE POSITIONS: The gearshift lever handle positions shall be as follows:

First speed	Forward and left.
Second speed	Rear and left.
Third speed	Forward and right.
Fourth speed	Rear and right.
Reverse	Guarded by a latch in separate gate. Extreme left through neutral, then forward.

192. CLUTCH AND BRAKE PEDAL: The clutch pedal should be located to the left, and the foot brake pedal to the right, of the fore and aft center line of the steering column.

193. ACCELERATOR PEDAL: The accelerator pedal shall be placed to the right of the brake.

194. SPARK AND THROTTLE HAND LEVERS: The spark and throttle hand levers shall be located to the right of the fore and aft center line of the steering column. The spark lever shall be the shorter of the two, and both levers carried on stationary sectors. The words "Spark" and "Throttle" are to be clearly marked on the levers. Both levers shall be arranged so that they are pushed forward to advance the spark and to open the throttle.

195. The spark and throttle sectors shall be marked to indicate the open and closed positions of throttle, and advance, retard, and battery starting positions of spark.

196. DATA PLATE: A suitable data plate must be installed in a readily observable location. The data on the plate must include the following:

Normal load capacity, pounds	3,000
Maximum speed, miles per hour	15
Serial number of motor	
Serial number of chassis	

197. SEAT AND TOP: The trucks will be provided with seat and top shown on drawing Q. M. G. O. No. T-106.

198. FENDERS: The trucks must be provided with front fenders only. These fenders must be of suitable design and rigid in construction.

199. BODIES: Bodies are not to be furnished unless specifically called for. The construction of chassis shall be such as to permit the proper installation of body on same, having inside dimensions of 5′ 1″ wide, 10′ long, and 2′ high, with the floor of body at a height of not over 45 inches above the ground when the truck is loaded. The length of frame back of driver's seat shall be 10 feet.

200. In fastening the body to chassis, neither the frame nor the frame mem-

bers shall be drilled, except the fastening for angle plate shown on drawing QM.GO. No. T-105. The body shall be fastened to the frame by means of suitable bolts, as shown on drawing T-107.

201. PAINTING: The entire chassis shall be first thoroughly cleaned of all dirt, grease, or oil, and covered with a coat of best quality, rust-resisting paint. It shall then be painted with three coats of best quality lead and oil, olive drab color, of the following composition:

6 lbs. white lead ground in linseed oil,
1 lb. raw umber,
1 pt. turpentine,
½ pt. japan drier.
1 qt. linseed oil.

202. Each coat must be permitted to become thoroughly dry before applying the next coat.

Transmission and Running Gear

203. CLUTCH: The clutch may be either dry multiple disc or dry single disc type, having one series of plates faced with wire asbestos friction material. It must be of suitable design for transmitting the maximum torque of the engine without slipping, must be easily accessible for repair or replacement of parts, and must be provided with a suitable arrangement for permitting easy engagement which will not require frequent adjustment or renewal of friction material.

204. Flanges must be fitted on the clutch pedal in order to prevent the driver's feet from slipping off of same. The pressure on the clutch pedal pad necessary to disengage the clutch must be not more than 90 pounds nor less than 70 pounds.

205. The clutch must be readily adjustable or provided with a spring which will give uniform action of the clutch during the wearing life of the friction material.

206. The clutch must be readily removable without disturbing the transmission, steering gear, motor, or other important parts, and must be provided with an effective clutch brake.

207. The clutch must be completely inclosed in order to prevent the entrance of dust, oil, or water.

208. The steel clutch discs must be properly hardened, and those without ring friction facing to be ground to a smooth surface.

209. All thrusts must be self-contained when the clutch is engaged.

210. The clutch release must be fitted with ball bearings, with adequate provision for lubrication. Plain clutch thrust bearings will not be acceptable.

211. TRANSMISSION DRIVE SHAFT: The transmission drive shaft, connecting clutch with transmission, must be provided with two universal joints of the lubricated bearing type. The fabric type of joint will not be acceptable. The joints must be entirely inclosed and means provided for suitable lubrication and for retaining the lubricant in the joint. Provision must be made to prevent the shaft whipping loose in the event of joint failure.

212. TRANSMISSION: The transmission shall be of the selective sliding gear type, and must have not less than four speeds forward and one reverse, and must be installed as a separate unit on a sub-frame between the engine and differential. It must be installed with a three-point mounting in order to prevent the distortion of frame from breaking the transmission legs. The high speed gear shall be direct without reduction in the transmission unless the truck is four-wheel drive.

213. The gears of transmission must be cut on suitable gear shapers or gear generating machine, from forged steel blanks of alloy steel equal to S. A. E. specification Nos. 2320, 3120, or 3320, properly case hardened and accurately assembled to a quiet running fit under load. These gears must have sufficient width of face and strength to transmit the full power of the engine at all gear ratios, with a proper factor of safety.

214. The splined driving shaft for sliding gears must be made of best quality alloy steel, properly heat treated.

215. The low gear ratio of transmission shall be suitable for giving a tractive factor of not less than .338, as required by paragraph 30, and the total low gear reduction of transmission and final drive shall be not less than 40 to 1.

216. The transmission case must be oil-tight, and must be provided with a filler plug on the top or side, a suitable drain plug on the bottom, and an oil level plug on the side of case.

217. The main drive shaft, and also the countershaft of transmission, must all be provided with ball or roller bearings of best make and suitable capacity. The use of plain bearings in the transmission assembly will not be permitted, except in the case of the reverse gear. If the bearings are adjustable, the adjustment must be accomplished by the use of shims.

218. The transmission must be accessible from below the body for inspection, adjustment, removal, or repair. Transmission gears constructed as an integral part of the rear axle, or in any other manner which does not provide proper spring suspension, will not be acceptable.

219. PROPELLER SHAFT: The propeller shaft connecting the transmission with the rear axle and differential must be of suitable size and strength to properly transmit the full power of the engine at all gear ratios, under the most severe service conditions. It must also be of such design, and must be supported in such a manner, as to prevent whipping or excessive vibration at all reasonable coasting speeds. The slip joint shall be fitted with an S. A. E. standard or similar spline connection.

220. SLIP JOINT: The slip joint for lower end of propeller shaft must be provided with S. A. E. standard splines, and must be designed in such a manner as to prevent the formation of a shoulder on the inside of joint. This slip joint must also be provided with a suitable tight fitting leather boot which will prevent the entrance of dust or water.

221. Suitable provision must be made for preventing the propeller shaft from whipping loose in case of the failure of the front universal joint.

222. Two universal joints must be provided between the transmission and differential. These universal joints must be so designed as to contain a proper quantity of lubricating grease, and must each be provided with a tight leather boot made of best quality, first cut leather. The use of fabric universal joints will not be permitted.

223. The leather boots specified must be provided irrespective of the type of universal joint which is employed, and must be provided at each end of boot with suitable screw clamps.

224. DRIVE AXLE: The trucks may be either internal gear drive, chain drive, worm gear drive, or double reduction gear in a central housing. The driving axle may be either full-floating or semi-floating type.

225. The design, material, and construction of the drive axle and final drive shall be in every respect in accordance with the best standard practice.

226. DRIVING AXLE BEARINGS: The driving axle must be provided with suitable solid steel taper roller or two-point ball bearings of best make. All bearings must be provided with suitable means for lubrication and for retaining the lubricant in the bearings. All thrusts must be compensated for by adjustable ball or roller bearings. The plain type of thrust bearing or three-point ball bearings will not be permitted.

227. The rear axle housing must be oil-tight, and must have an inspection plate, giving ready access to the inside of housing. An oil filler plug must be provided at a proper height to act as an overflow in filling. If the oil filler plug is located in the inspection plate, the studs for holding the plate must be so arranged as to prevent the plate from being reversed. The differential complete must be readily removable after removing the splined drive shafts.

229. DIFFERENTIAL: The differential shall be of such a type as to automatically permit the wheels to revolve at different speeds without complete loss of torque on either wheel, and also to apply at least normal torque to whichever wheel shall have traction. These requirements shall be met when the vehicle is running either forward or backward.

230. It shall consist of a forged steel or cast steel case, to which the large gear is attached by being bolted or riveted. This case shall also contain the necessary gears for producing the required differential action, and shall be provided with suitable steel roller or ball bearings of best make. The case shall be supported on its bearings independent of the drive shaft ends. The drive shaft ends shall be properly fitted and connected by means of suitable splines to the gears in differential case. The spline connection shall be made in accordance with S. A. E. standards.

231. All steel differential or driving gears shall be machine cut on suitable gear generators, from forged blanks of S. A. E. steel Nos. 2320, 3120, or equal, and properly heat treated.

232. The bevel drive pinion shall be forged integral with its shaft. This shaft shall be made of steel equal to S. A. E. specification No. X3335, properly

heat treated, and provided with two sets of taper roller or ball bearings of best make, and provided with suitable means for the ready adjustment of the bevel driving pinion in relation to the large driven gear, and vice versa. If ball bearings are used, suitable means shall be provided to take care of thrust loads.

233. WORM OR BEVEL GEAR DRIVE: If the rear axle is of the worm or bevel gear driven type, it may be a built-up structure using steel tubes pressed or shrunk into a properly ribbed cast steel or malleable iron housing, or a suitable one-piece cast steel or malleable iron axle housing may be used without any steel tubes. Truss rods may be used at the discretion of the constructor, but the factor of safety of the rear axle load carrying assembly or member must be large enough to preclude any likelihood of breakage under the most severe service conditions.

234. INTERNAL GEAR DRIVE: If the final drive is an internal gear, provision must be made for entirely inclosing the driving gears, and for retaining the lubricating oil or grease, and for preventing same from getting onto the brake bands.

235. Both the spur driving pinion and the internal gear shall be machine cut from drop forged steel blanks. The internal gear ring may be made of carbon steel equal to S. A. E. specification No. 1020, properly heat treated for the purpose, but the spur driving pinion must be made of steel equal to S. A. E. specification Nos. 2320, 3120, or 3320, suitably case hardened. Both gears must have wide faces and must be so designed and constructed as to readily withstand the maximum power of the engine under the most severe service conditions, with a proper factor of safety.

236. All gears connected with this drive must be heat treated in the most suitable manner. The internal gear must be pressed onto turned flange on the wheel hub, and then firmly secured with suitable rivets.

237. The jack shafts shall be made of best quality chromium-nickel steel equal to S. A. E. specification Nos. 3140 or X3325, must be properly splined at each end for connecting with driving gear and differential, and shall be provided at each end with steel roller or annular ball bearings of best quality. These jack shafts shall be inclosed in steel tubing having flexible end connections in both the differential housing and the internal gear case, and these flexible connections shall be provided with suitable felt washers.

238. The wheel spindles shall be made of best quality chromium-vanadium steel equal to S. A. E. specification No. 6135, properly heat treated.

239. FRONT AXLE: The front axle shall be of I-beam section, drop forged from a single piece of carbon steel or alloy steel equal to S. A. E. steel No. 1035, and properly heat treated. The steering knuckles, and the steering knuckle levers, shall be drop forged from alloy steel equal to S. A. E. steel Nos. 2330, 3130, or 3325, and properly heat treated. The wheel spindles shall be provided with steel roller bearings of best quality, and provided with proper means of lubrication. The wheel hubs and bearings of both front and rear axles must be so designed as to prevent the entrance of water, dust or dirt, and also must prevent the leakage of grease from the hubs.

240. BRAKES: Two independent sets of double acting brakes shall be provided. The emergency brake must act directly on the rear wheels, and be operated by a hand lever with ratchet. Service brakes may act directly on the rear wheels or on the drive shaft, and must be operated by a pedal. Brakes must be lined with an approved friction material and must be so constructed that they may be readily adjusted and securely locked in adjustment without removing the wheels or other parts.

241. Suitable flanges must be fitted on the brake pedal to prevent the driver's foot from slipping off of same.

242. Brake rods are to be sufficiently stiff or so supported as to prevent whipping or rattling.

243. Brakes must be sufficiently powerful either to slip the wheels or stop the truck within a distance of not more than fifty feet, with either the service brakes or the emergency brakes, when the normally loaded truck is running on a level, hard, and dry macadam road at a speed of fifteen miles per hour.

244. The service brakes may act directly on the drive wheel, brake drums, or on the driving axle next to the propeller shaft.

245. Brake adjustments must be readily accessible, and must be adjustable without the use of special tools. All brake clevises, pins, or other bearings in brake rods or brake connection must be provided with bronze bushings.

246. The design of brakes and brake connections must be such that the application of drive wheel brakes is not affected by relative movement between the frame and axle.

247. Both the service brakes and the emergency brakes must be readily adjustable for taking up wear, and must be provided with as large an amount of radiating surface as practicable. Provision must also be made for holding the braking surfaces on brake bands or brake shoes concentric with the brake drum surface. The brakes must be so designed as to release completely and not drag at any point when the brake lever or pedal is released. The brake drums must be exactly circular, and the central opening in same fitted over a finished boss on the wheel hub, or other method equally effective which will retain the brake drum must be fastened to the wheel with suitable tight fitting bolts. Provision must also be made for preventing oil or grease from leaking out of the axle or drive shaft ends and getting onto the brake bands and drums.

248. All brakes must be mounted in such a manner that the braking strains will be taken by parts which are strong enough to withstand these strains under the most severe braking conditions.

249. WHEELS: The wheels shall be of suitable size for the use of 36-inch S. A. E. demountable solid tires, and shall be best quality cast steel wheels, of proper design, strength, and construction, and made in accordance with the best standard practice.

250. The wheels shall be of suitable size and design for the use of 36″x4″ single, solid S. A. E. demountable rubber tires on front wheels, and 36″x7″ single, solid S. A. E. demountable tires on rear wheels. All wheels shall be of proper strength to resist the vertical and lateral loads in the most severe service, and with the maximum load and speeds for which the truck was constructed.

251. The hubs of wheels shall be made of best quality cast or forged steel, free from blow holes which will impair the strength or finish of finished hub, and must be provided with best quality hardened and ground roller or annular ball bearings of proper size. The hubs may be integral with the wheel casting.

252. DEMOUNTABLE TIRE FASTENINGS: The steel fastenings for demountable tires shall be constructed in accordance with drawing Q. M. G. O. No. T-101. Trucks will positively not be accepted having tires or tire fastenings which differ from those herein specified.

253. TIRES: On two-wheel drive trucks the tires shall be 36″x7″ single tires on rear wheels, and 36″x4″ single tires on front wheels, both front and rear tires demountable.

254. On four-wheel drive trucks the tires shall be 36″x6″ single, demountable, both front and rear.

255. All tires shall be best quality solid rubber tires on hard rubber base with S. A. E. steel rims. A sample section of the rubber tire and rim must be submitted with each proposal.

256. Complete detail and assembly drawings, showing the construction, material and dimensions of all parts of the wheels must be submitted.

257. HUB ODOMETER: A hub odometer of best make, and of suitable design and construction for most satisfactory use on motor trucks, shall be provided and installed on one of the front wheels. This odometer shall have not less than five figures in the dial, and provision shall be made to prevent leakage of grease into mechanism.

Springs

258. SPRINGS: The chassis spring suspension must be of such design and construction as to relieve the body and chassis above springs of excessive vibration when the vehicle is traveling empty or partially loaded over rough surfaces at maximum speed.

259. Springs must be made of alloy steel, heat treated to develop the following physical properties:

Minimum elastic limit, 170,000 lb. per square inch
Tensile strength, not less than 210,000 lb. per square inch
Elongation, not less than.....5% in 8 in.
Brinell hardness 390-470

Care must be exercised to prevent specimen from slipping in the grips and causing diagonal strains.

260. DEFLECTION OF SPRINGS: The deflection of rear springs shall be not more than 1,000 pounds per inch and not less than 800 pounds per inch. The deflection of front springs shall be not more than 800 and not less than 550

pounds per inch. The maximum deflection permitted by the permanent stops, both front and rear, must be given.

261. Spring eyes must be provided with phosphor bronze or soft steel bushings, pressed in and reamed in position to the S. A. E. limits of tolerance for such bushings. Bushings must have suitable lubricating channels and conform to S. A. E. standard of wall thickness. If phosphor bronze is used, it must be equal to S. A. E. specification No. 26.

262. Spring eye bolts must be hardened and ground to S. A. E. standard sizes and tolerances. Eye bolts must be securely anchored to prevent turning in the spring shackles, and be provided with suitable means for lubrication.

263. Spring shackle bolts or cross bars must be properly hardened and ground on bearing surfaces and be so designed as to provide at least equal projected bearing area to that provided by the eye bolts. Where shackle bolts are used in connection with bat shackles, they must be provided with suitable means of lubrication and be securely anchored to prevent turning in the shackle. The spring shackle bolts shall also be made to S. A. E. sizes and tolerances.

263a. SPRING SHACKLES: Spring shackles must be made of a material equal to S. A. E. specification No. 1235 for steel castings, and heat treated. They must have a center to center distance not less than the spring width, and may be of two types—Bar shackles formed of two plates with a connecting bar formed integral with them, or yoke shackles, having one end open and the other end connected and adapted to receive the shackle pin or bar. Where yoke shackles are used, they must be bushed at the shackle pin or bar end with a material equal to S. A. E. specification No. 26, or soft steel, bushing to have ⅛" walls, lubricating channels, and suitable means of lubrication. Yoke shackles must be so designed as to provide projected bearing area at the closed end at least equal to that of the spring eyes. Rear spring shackles must be in tension. Spring shackles or hangers must be so constructed as to prevent binding on the sides of the spring eyes or the supporting brackets.

264. SHACKLE HANGERS: Shackle hangers, when used in connection with bar shackles, must be bushed with a material equal to S. A. E. specification No. 26 or soft steel, said bushings to have ⅛" walls, and be provided with suitable lubricating channels and means of lubrication.

265. SHACKLE POSITION: In the design of springs and the assembly of same on chassis, the spring shackles must stand in approximately a vertical position when the spring is under full load, except on chain driven vehicles, where shackles must stand at an angle sufficient to allow chain adjustment without cramping the spring main plates.

266. SPRING LEAVES: Spring leaves must be held against longitudinal movement by means of an alloy steel center bolt of proper size, by an indentation in the center of each leaf, or by a combination of those methods. If center bolts are used, the head shall conform to S. A. E. standard, and be provided with snug fitting S. A. E. standard center bolt nuts and means provided for locking the nuts in position. Springs with shrunk-on center bands will not be acceptable because of the difficulty of making repairs in field service. Center fastening must be shown in detail on the drawing mentioned in paragraph 279.

267. SPRING CLIPS: Spring clips must be made of alloy steel equal to S. A. E. No. 3130 or 3320, properly heat treated, to develop physical properties equal to the following:

Elastic limit	100,000 lb. per square inch
Tensile strength	130,000 lb. per square inch
Elongation	20% in 8 in.
Reduction of area	60% in 8 in.
Brinell hardness	295
Scleroscope	35

268. Spring clips must be constructed in accordance with S. A. E. standards. The chemical specifications, physical properties, and heat treatment must be given. The use of carbon steel spring clips will not be permitted. Nuts may be of carbon steel.

269. METAL SPRING CHAIRS: Metal spring chairs must be provided between springs and spring seats. Chairs must be so designed as to be held by the spring clips against longitudinal movement, and have one face shaped to conform to the shape of the spring when the spring is free or without load. The center of the chair must be recessed to properly receive the center fastening of the spring. Spring chairs may be omitted where the spring seat is shaped to conform to the shape of the spring when the spring is free.

270. PRESSURE BLOCKS: Pressure blocks, of a material equal to S. A. E. specification No. 1235 for steel castings, heat treated, must be provided between the spring clips and the spring, and must be grooved and conform to the shape of the spring clips where in contact with the clips. The face of pressure blocks must conform to the shape of the spring when the spring is free.

271. PERMANENT STOPS: All vehicles must be provided with permanent stops which will prevent the springs from being deflected to a point at which the stress will be greater than 75 per cent of the elastic limit of the material from which the springs are made. Suitable rubber or steel buffers must also be provided for both front and rear springs.

272. REBOUND CLIP: A suitable number of rebound clips must be provided on each spring, and attached in such manner as to retain their proper position. These rebound clips must be constructed in accordance with S. A. E. recommended practice.

273. LUBRICATION: The lubrication of all spring connections must be through grease or oil cups, which must be so located as to be readily accessible and of ample capacity, and so designed as to prevent any part of the cup shaking loose through vibration. When cups are not formed integral with the spring connections, they must be screwed in position with standard ¼" taper pipe thread; at least four threads of shank must be engaged.

274. RETAINING ALIGNMENT: Springs must be provided with suitable means for retaining the leaves in proper alignment with each other. The method used must be shown in detail in the drawing mentioned in paragraph 279.

275. Scale formed on leaves during heat treatment shall be removed as thoroughly as possible without breaking surface skin.

276. All springs must be constructed and tested in accordance with S. A. E. standards and recommended practice, and must comply with these requirements.

277. DRIVING THRUST AND TORQUE: The driving thrust and torque may be transmitted through radius rods, the torque may be taken through torque arms, or the springs may be designed to take either or both torque and thrust.

278. If power or torque is transmitted through the chassis springs, the design must be such that the vehicle will not be rendered inoperative through breakage of the main or driving leaf of the spring, and the axle attachment must be such as to prevent relative longitudinal movement of the spring on its seat.

Data to Be Supplied with Proposals

279. The following information must be furnished with each proposal. Illustrations, catalogues and specifications, showing the construction of the truck bid upon, should also be submitted. Failure to supply this data will render the proposal informal, and may result in its rejection.

ENGINE AND COOLING SYSTEM

(1) Manufacturer of truck.....
(2) Manufacturer of engine.....
(3) Bore.....inches. Stroke.....inches
(4) Number of cylinders.....
(5) Dimensions of Bearings

Crank Shaft	Diameter	Length	Projected Area
Front			
First inside			
Second Inside			
Rear			
Connecting Rod			
Crank			
Piston pin			

(6) Weight of flywheel, clutch, and other parts supported by shaft, rear engine bearing to first universal joint.....
(7) Weight of connecting rod complete, with bushings, bearings, bolts, and screws:
Crank end .....
Upper end .....
(8) Weight of piston complete, with pin, set screws, and rings.....
(9) Make and thickness of anti-friction metal used.....
(10) Are main bearings and connecting rod bearings bronze backed or die cast?.....
(11) Speed of motor corresponding to truck speed of 15 miles per hour on high gear.....
(12) Manufacturer and type of governor.....
.....
(13) Manufacturer and type of carbureter.....
.....

(14) Type of water circulating pump.....
(15) Method of lubrication of motor.....
(16) Type of oil pump.....
(17) Capacity of oil pump, gallons per minute, at 1,000 r.p.m. engine speed .....
(18) Oil pressure, at engine speed of—
(a) 1,000 r.p.m.....
(b) 500 r.p.m.....
(19) Lubricating oil capacity of crank case, in gallons.....
(20) Are engine, clutch, and transmission in unit power plant, or is transmission in separate unit?.....
.....
(21) Has complete valve timing data been submitted?.....
(22) The speed-power curve and speed-torque curve of engine with wide open throttle. The speed-power curve must be extended to the drooping point, if practicable, and the engine vibration points noted on the curve. The maximum speed of engine without excessive vibration must also be indicated on the curve.
(23) Gasoline consumption of fully loaded truck, in miles per gallon on high gear, when running over smooth macadam roads.....
.....
(24) Gasoline consumption in pints per H.P.H. on block test, at 1,000 feet of piston speed per minute, and a water jacket temperature of 180° F. at outlet of water manifold—
(a) At full rated load.....
(b) At three-fourths load.....
(c) At one-half load.....
(d) At one-fourth load.....
(e) In pints per hour at no load.....
(25) Gasoline consumption in pints per H.P.H. on block test, with wide open throttle, and maximum torque, at piston speed of—
(a) 250 feet per minute.....
(b) 500 feet per minute.....
(c) 750 feet per minute.....
(d) 1,000 feet per minute.....
The gasoline consumption data above required must be taken with one setting of the carburetors. The carburetor setting must not be changed when testing the engine at different speeds or loads.
(26) Cylinder oil consumption, in pounds per H.P.H., at 25 per cent of full load, and 1,000 feet of piston speed per minute. The physical properties of the oil used must also be given .....
(27) The mechanical horsepower required to drive the engine at a speed of 1,000 feet of piston speed per minute, with carburetor in place, and with throttle wide open.....
(28) Clearance volume in per cent of piston displacement.....
(29) Are cylinder heads removable?.....
(30) Location of valves: Both in head; one in head and one in ell; two in ell, or tee?.....
(31) Net weight of engine, complete with flywheel, clutch, carburetor, magneto, pumps, generator, fan, and manifolds.....
(32) Type and make of radiator.....
(33) Is radiator spring suspended?.....
(34) Water capacity of cooling system, gallons.....
(35) Frontal area of radiator, square inches, core only.....
(36) Depth of radiator core.....
(37) Area of radiator cooling surface, square inches.....
(38) Quantity of water delivered by pump, with engine speeds of—
(a) 500 r.p.m.....
(b) 1,000 r.p.m.....
(39) Power required to drive fan.....
(40) Is the radiator provided with fan housing.....
(41) Ratio of fan speed to engine speed.....
(42) Width and type of fan belt.....

ELECTRIC LIGHTING AND IGNITION

(43) At what point does spark occur with spark lever at—
(a) Full retard .....
(b) Full advanced position .....
(44) At what engine speed does generator or relay "cut in"?.....
(45) Speed and voltage of generator—
(a) When cut-out opens.....
(b) When cut-out closes, permitting current to pass to battery .....
(46) Weight of generator without gear or sprocket.....
(47) Ratio of speed between engine and generator.....
(48) The speed voltage curve, or tabulated data of generator—
(a) When delivering a current of one ampere.....
(b) When delivering a current of 12 amperes.....
(49) What is the make, type, and size of generator?.....
.....
(50) What is the length of spark between needle points delivered by magneto with engine speed of from 100 to 1200 r.p.m?.....
.....
(51) What is the length of spark safety gap?.....
(52) What is make, type, and size of magneto?.....
.....
(53) What is make, type, voltage, and ampere hour capacity of the storage battery?.....
.....
(54) What is make, type, and thread of spark plugs?.....
.....

TRANSMISSION AND RUNNING GEAR

(55) Manufacturer and type of—
(a) Clutch .....
(b) Transmission .....
(56) Total gear reduction, crank shaft to drive wheels:
(a) 1st speed (low gear).....
(b) 2nd speed .....
(c) 3rd speed .....
(d) 4th speed .....
(e) Reverse .....
(57) Gear reduction of transmission only:
(a) 1st speed .....
(b) 2nd speed .....
(c) 3rd speed .....
(d) 4th speed .....
(e) Reverse. .....
(58) Gear reduction of final drive.....
(59) Type of final drive.....
(60) Number of sprocket teeth—
(a) On jack shaft sprocket.....
(b) On wheel sprocket of chain drive.....
(61) Manufacturer and type of drive axle or jack shaft.....
.....
(62) Efficiency of power transmission from engine to rear wheels, on each of gear ratios and with full power of engine:
(a) 1st speed .....
(b) 2nd speed .....
(c) 3rd speed .....
(d) 4th speed .....
(e) Reverse. .....
(63) Maximum steady tractive effort at outer surface of drive wheels:
(a) High gear.....pounds
(b) Low gear.....pounds
(64) Tractive factor. Tractive effort divided by total weight of loaded truck—
(a) On high gear.....
(b) On low gear.....
(65) Make and type of—
(a) Front axle .....
(b) Rear axle .....
(66) Type of brakes.....
(67) Manufacturer and brand of brake lining used.....
.....
(68) Area of braking surface:
(a) Emergency brakes .....
(b) Service brakes .....
(69) Distance required to stop normally loaded truck, from speed of 15 miles per hour, on hard level macadam road.....
(70) Does truck steer with front wheels, rear wheels, or both front and rear wheels?.....
(71) Manufacturer and type of steering gear.....
.....
(72) Diameter of steering wheel.....
(73) Minimum diameter of turning circle.....
(74) Diameter and width of—
(a) Front tires.....
(b) Rear tires.....Single or dual?.....
(75) Total area of rubber, both soft and hard, in tire section.....
.....
(76) Area of rubber above top of channel.....
(77) Specific gravity of soft rubber.....
(78) Tensile strength of soft rubber, in pounds per square inch, at given temperature .....
(79) Stretch and set of 2-inch lengths of rubber in small strips, at given temperature.....
(80) Per cent by volume of—
(a) Fine Para rubber in tires.....
(b) Other rubbers in tires.....
(81) Guaranteed mileage of tires when used—
(a) In the Military field service.....
(b) On ordinary smooth roads or streets.....
(82) Trade name of tires.....
(83) Name of manufacturer of tires.....

WHEELS

(84) Make and type of—
(a) Front wheels.....
(b) Rear wheels.....
(85) Weight of each wheel complete with tires specified—
(a) Front .....
(b) Rear .....
(86) Make and type of bearings in—
(a) Front wheels.....
(b) Rear wheels.....

SPRINGS

Drawings must be furnished showing in detail the method of fastening the leaves at spring center, the number, location, and method of fastening rebound clips, and the method of retaining the leaves in proper alignment with each other. These drawings must also bear in tabulated form the following information:
(87) Chemical specifications of steel from which—
(a) Springs are made.
(b) Spring clips are made.
(88) Heat treatment.
(89) Physical properties after heat treatment, including Brinell and scleroscope tests.
(90) Type of spring (S. A. E. nomenclature).
(91) Width of Spring—
(a) Nominal.
(b) At eyes.
(92) Length of spring under load, center bolt to bearing point of eyes—
(a) Front end .....
(b) Rear end .....
(93) Height of spring under load, both front and rear, measured from spring seat to center of eye, or to bearing point.
(94) Flexibility in pounds per inch of deflection—
(a) Front spring .....
(b) Rear spring .....
(95) Length of short leaf.....
(96) Thickness and number of leaves, and of individual leaves, counting from main leaf.....
(97) Inside diameter of bushing.....
(98) Outside diameter of bushing.....
(99) Diameter of center bolt.....
(100) Diameter of center bolt head.....
(101) Height of center bolt head.....

FRAME

(102) Maximum depth of frame..... inches
(103) Width of flange..... inches
(104) Thickness of frame stock..... inches
(105) Kind of steel in frame..... inches
(106) Length of frame back of driver's seat..... inches
(107) Height of frame at rear axle.....
Truck empty and without body..
.....
With maximum load at center of rear springs. State definite load for the deflection.....
.....
.....

WEIGHTS AND DIMENSIONS

(108) Shipping weight of chassis, including all accessories and spare parts as specified herein..... lbs.
(109) Weight of chassis only—
(a) On front wheels..... lbs.
(b) On rear wheels..... lbs.

(110) Weight of chassis loaded—
(a) On front wheels..... lbs.
(b) On rear wheels..... lbs.
(111) Total length of chassis over all.....
(112) Total width of chassis over all.....
(113) Wheelbase .....
(114) Tread, center to center of felloe band—
(a) Front wheels .....inches
(b) Rear wheels ..... inches

GROUND CLEARANCE

(115) Minimum ground clearance—
(a) Center of rear axle..... inches
(b) Center of front axle..... inches
(c) Any part of front axle..... inches
(d) Any part of rear axle..... inches
(e) At drive sprockets ..... inches
(f) At brake drums ..... inches
(g) At flywheel ..... inches
(h) Between axles ..... inches

DATA

(116) Have data required by paragraphs 11 to 22 and 279 been submitted? .....

EQUIPMENT

280. The following equipment shall be furnished and installed on each truck:

(1) 1—Diaphragm hand horn of best make. This horn shall be installed in a rigid manner, in a location readily accessible from the driver's seat, with proper through bolts, nuts, and lock washers.
(2) 1—Fire Extinguisher of best make, 1 quart capacity, with suitable bracket, mounted in a vertical position in a readily accessible location.
(3) 1—Foot rest of suitable design, to be installed in a suitable location near accelerator pedal.

281. The following equipment is to be placed on and shipped with each individual truck. This equipment must not be shipped separately:

(1) 1—Set solid end wrenches, of suitable quality steel, to fit all nuts on truck.
(2) 1—Socket wrench for spark plugs, with handle.
(3) 1—6" Adjustable end wrench of best make.
(4) 1—10" Adjustable end wrench of best make.
(5) 1—Screwdriver of best make, 4" blade, with insulated handle.
(6) 1—Screwdriver, large, with square shank for wrench.
(7) 1—Pair 6" side cutting pliers of best make.
(8) 1—Pair 7" combination gas pliers of best make.
(9) 1—Cold chisel, ¾-inch blade, 6" long.
(10) 1—Steel punch, ⅜" point, ¾-inch stock, 6" long.
(11) 1—Machinist's hammer, ball peen, with best quality hickory handle.
(12) 1—Cotter pin puller and spreader.
(13) 1—Box assorted cotter pins.
(14) 4—Spark plugs of best make, with gaskets.
(15) 1—Jack of best quality and of suitable lift. Must be of sufficient length and strength to permit one man to readily raise any wheel of the fully loaded truck. Not less than 3-ton capacity.
(16) 1—Set of tire chains for each drive wheel. The drive wheels may be equipped with individual cross chains which fasten to the wheels.
(17) 1—Shovel, short handled, round point, "D" handle, socket strap, of best quality crucible steel.
(18) 1—Galvanized iron bucket of best make, 2½-gallon capacity.
(19) 150 Feet Manila rope, best quality, ⅝" diameter.
(20) 1—Rubber or canvas pail, 2½-gallon capacity.
(21) 1—Best quality grease gun.
(22) 2—Gallons engine cylinder oil of best quality, medium grade, in sealed can.
(23) 1—Gallon gear oil of best quality, in sealed can.
(24) 1—Quart kerosene, in sealed can.
(25) 1—Small piece of packing for water pump gland, sufficient for two complete packings.
(26) 1—Extra condenser for magneto or timer.
(27) 1—Battery flashlamp of best make, 8" long, 1½" diameter, 3-cell, with tungsten bulb and glass lens, and extra battery for same.
(28) Instruction books, oiling diagrams, giving complete instructions for care and operation of truck.

Standard Specifications
for
3-Ton Gasoline Motor Trucks

The specifications for 1½-ton trucks shall apply in the furnishing of 3-ton trucks, except in the following particulars. Numbers in brackets refer to paragraph numbers in the 1½-ton truck specifications.

1. (24) LOAD CAPACITY: The trucks must be of sufficient strength, and provided with sufficient power, to carry and propel the following gross load under the most severe service conditions:

Pay load	6,000 lb.
Body	1,500 lb.
Three men	525 lb.
Extra equipment	200 lb.
	8,225 lb.

The extremely severe service conditions under which these trucks will be operated indicate that they should be designed for a nominal pay load of 7,000 to 8,000 pounds.

2. (26) WEIGHT OF CHASSIS: The maximum weight of chassis, without body or extra tool and parts equipment, and without gasoline, water, or oil, must be not more than 8,000 pounds. A definite statement must be made showing exactly what equipment is included in the stated weight.

3. (32) WHEELBASE: The wheelbase must be suitable for the use of a 12 foot body, and shall be not less than 124 inches or more than 156 inches.

4. (34) GAGE: The gage of wheels on 3-ton trucks, measured from center to center of fellow bands, shall be as follows:
5" Single front tires—59½ to 64½ inches
5" Dual rear tires—64½ inches

5. (35) ENGINE: The engine must be of the 4-cycle type, water cooled, having not less than four cylinders, and provided with mechanically operated poppet valves. It shall have a total piston displacement of not less than 414 cubic inches and must develop a torque of not less than 2,475 inch pounds at not more than 1,000 feet of piston speed per minute. The torque at 500 feet of piston speed per minute shall be not less than 90 per cent of the maximum torque. The engine must be under a removable hood, and located in a readily accessible position. The hood must be waterproof, readily removable without removing screws or bolts, and must open up sufficiently wide to permit of easy access to engine for inspection or adjustment. All main and connecting rod crank end bearings shall be so designed as to be easily adjusted to take up wear. The piston pin bearing shall consist of a suitable phosphor bronze bushing properly secured in the connecting rod end. The valve stem guides and push rod guides shall not be as integral with the cylinder casting, but must be separate parts, properly secured in place. The lower half of the crank case must be removable without disturbing the main bearings or the clutch housing, or removing the engine from the chassis. The unit power plant type of construction will not be permitted. The transmission must be mounted as a separate unit.

6. (177) The distance from the back of the driver's seat to the rear end of frame shall be 11 feet 11 inches. This frame length will permit of sufficient overhang of body to allow the installation of towing hooks and rear bumpers.

7. (196) DATA PLATE: A suitable data plate must be installed in a readily observable location. The data on the plate must include the following:

Normal load capacity, pounds	6,000
Maximum speed, miles per hour	12
Serial number of motor	——
Serial number of chassis	——

8. (199) BODIES: Bodies are not to be furnished unless specifically called for. The construction of chassis shall be such as to permit the proper installation of body on same, having inside dimensions of 6' 6" wide, 12' long, and 2' high, with the floor of body at a height of not over 45 inches above the ground when the truck is loaded. The length of frame back of driver's seat shall be 11', 11".

9. (215) The low gear ratio of transmission shall be suitable for giving a tractive factor of not less than .338, as required by paragraph 30, and the total low gear reduction of transmission and final drive shall be not less than 50 to 1.

10. (250) The wheels shall be of suitable size and design for the use of 36" x 5" single, solid S.A.E. demountable rubber tires on front whels, and 36" x 5" dual, solid S.A.E., demountable tires on rear wheels. All wheels shall be of proper strength to resist the vertical and lateral loads in the most severe service, and with the maximum load and speeds for which the truck was constructed.

11. (253) TIRES: On two-wheel drive trucks the tires shall be 36" x 5" dual tires on rear wheels, and 36" x 5" single tires on front wheels, both demountable.

12. (260) DEFLECTION OF SPRINGS: The deflection of rear springs shall be not more than 1500 pounds per inch and not less than 1000 pounds per inch. The deflection of front springs shall be not more than 900 and not less than 650 pounds per inch. The maximum deflection permitted by the permanent stops must be given.

EDITOR'S NOTE—The standard specifications for 3-ton gasoline motor trucks are published by the government in the form of an appendix to the general specifications to indicate points of difference.